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ABSTRACT

This activity packet for grade 6 is one of a series developed in response to the concern for energy conservation. It contains activities that stress an energy conservation ethic and includes many values clarification activities for grade six. The packet is divided into two parts and provides the teacher with background information, concepts and objectives, and activities for each part. Part one is concerned with the limits of energy sources and part two with alternative energy sources. Two annotated bibliographies, one for teachers and the other for students, are also included. The teacher is provided with ditto and transparency master pages for duplication. An evaluation sheet and a listing of resources are also a part of this activity packet. (MA)

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ENERGY

Conservation Activity Packet

Grade 6

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NOTE TO SCHOOLS AND TEACHERS

The filmstrips referred to in the 5th and 6th grade sets can be borrowed from your local AEA. The AEA's have five (5) sets of the filmstrips available. You may wish to make arrangements with them for purchasing a copy of these filmstrips for your own building. The cost was prohibitive for us to include the filmstrips in each packet.

Thank you for your understanding.

ENERGY CONSERVATION ACTIVITY PACKETS

Ruth Bakke
project writer/coordinator

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Northwest School
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- Steve Rue
- Ruth Bond
- Lucretia Smith

Southeast School
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- Marge Ranney

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INTRODUCTION TO ENERGY PACKETS

The energy shortages and emergencies with which we are faced attest the treatment humans have given to their natural surroundings. Not only do we experience personal inconveniences but we also see severe economic and environmental consequences. Our nation has arrived at a time when it needs to reevaluate where it is going, at what speed, and how it will eventually arrive at that goal. The National Academy of Sciences generally agrees that the reserves and resources of domestic oil, gas and coal will satisfy energy needs in the United States until the year 2000. Presently the United States doubles its energy consumption every 13 years. In 1975, electric companies burned 507 million barrels of oil to generate electricity, 500 million barrels were burned to heat factories. Much of the oil and natural gas consumed could be replaced by coal, thus drastically reducing oil imports.

The instructional program in a school can examine this energy situation with reason and logic. When a social issue is integrated into the total curriculum, it helps children to apply what they are learning. The educational process can help students become aware of the alternatives and consequences in regard to energy, then guide them to choose a value. Students can learn that it is just as exciting to make something last as it is to develop something new.

Through use of the enclosed materials and activities, it is our intent to stress a conservation ethic. The conservation ethic means more than turning lights off, it has wider implications such as developing new industries to recycle metals, making more durable products, and prioritizing fuel uses.

Our values show what we tend to do with our limited time and energy. They are related to the experiences that shape them. In order to help children develop clearer values, teachers must help them use the process of valuing. Students become much more purposeful when they have been given opportunities to clarify their values.

Each packet contains values clarification exercises designed to carry out the stated objectives. The teacher may wish to use a specific model to develop more exercises. You will find that the valuing process is another tool for the teacher. When used, it leads children from apathy and confusion toward positive learning and life-styles.

The goal of providing the types of activities, which have been included, is to create a growing awareness for the need of dealing with existing energy problems in a positive way. Individual teachers should select objectives which they feel reflect the needs of a particular class. Each packet contains an energy concept and an awareness or accommodation concept. It is imperative to include objectives from each conceptual area as the purpose of these packets is to develop an energy conservation ethic within the students of today that they

may become conserving and concerned citizens of tomorrow. Changes may not occur immediately due to home and parental values; however, as they become adults, this learning will show its effects.

Each packet includes many activities for the teaching towards the stated objectives. Teachers need choose only those activities which they feel will accomplish their objectives. The teaching of energy and its conservation is designed to be interdisciplinary in order that students see that energy cannot be isolated from our daily lives. This is also important in developing the conservation ethic.

Within the packet, teachers will find transparencies, posters, filmstrips, etc. which may add to the teaching of energy and development of conservation. Suggestions and criticisms from teachers, consultants, etc. would be appreciated and considered in keeping these packets suitable for the majority of school systems.

Most young children in the primary grades are within the concrete operational stage, as named by Piaget. They do not have the ability to separate the abstract from something. Therefore, the activities which have been proposed reflect this and provide for greater awareness, rather than a formal study of energy. Individual teachers know their students best and will need to select items which they feel will be of greatest benefit to the education of the children. This is also the reason the concepts and objectives for the primary grades (K-2) have been combined in one packet. There are some classroom activities which require about 20 minutes each, some 40 minutes, and there are also some activities which can be done at home in order to enable children to work with their families.

ENERGY CONSERVATION ACTIVITY PACKETS

GRADE 6

PACKET "A"

TEACHER BACKGROUND MATERIAL
Grade 6 - Packet "A"

As the years pass by, people not only are using more energy but there are more people using energy. In 1900 in the U.S. there were 75 million people and they each used 100 million Btu's of energy. Seventy-five years later, the population increased to 211 million Btu's of energy. Based on population growth, consumption, and geological speculations, the U.S. can estimate how long our supply of fossil fuels will last. For instance, coal, the most abundant fossil fuel in the U.S., could last about 500 years at our present rate of consumption. This would not be the case, however, if coal were used as a substitute for oil and natural gas as those reserves are depleted. Energy conservation can provide us with the time needed to develop alternate energy sources such as solar, geothermal, wind, and nuclear power.

Much energy is used to manufacture and process the items we buy. Products made from used or recycled materials generally take less energy than products made from new materials. For example, new aluminum uses 20 times as much energy as recycled aluminum, new paper uses twice as much energy as recycled paper, and man-made fabrics use 10 times as much energy as natural fabrics. Every ton of steel produced from recycled waste instead of raw ore does the following things: (1) saves enough energy to power the average American home for eight months, (2) eliminates 200 pounds of air pollutants, (3) reduces fresh water consumption by 6,700 gallons, (4) reduces wastes discharged into water by 107 pounds, and (5) eliminates about three tons of mining wastes. Throwing away one bottle wastes as much energy as a 100-watt bulb uses in four hours.

Recycling is not a modern concept. Pioneers recycled metal into buttons by taking old spoons and other pieces of worn-out tableware, melting them, and casting them in molds which had been cut into blocks of soapstone. Lemon and orange peels were also saved, dried, and used as a substitute for kindling wood. It not only revives a fire but also lightly perfumes a room.

The fuels which we have used for our personal needs have also taken us into the space age. These fuels, however, are rapidly being exhausted. At several times in history we have located new sources of energy and approached them with the idea that the supply was inexhaustible. Now we are beginning to realize that the earth is limited in its ability to satisfy our demands.

Our use of energy has extended beyond needs into the category of wants. The U.S. has traditionally been proud of substituting mechanism for muscle power, yet now must face the hard facts that the energy required is quickly being depleted. Energy conservation needs to dwell on the careful and intelligent use of the resources we have.

The average American produces about 4 1/2 pounds of trash per day, yet things can be done to reduce the national solid waste problem which has developed. Some companies pay out money to consumers who recycle and some craft shops contain items which have been recycled in a creative manner. In addition to reducing consumption of materials and reusing what we normally throw out, we need to look again at our buying habits. As you can see, it makes more sense to purchase products that are long-lasting and recyclable.

Some of the activities in the 6th grade packet require between 20 and 40 minutes depending upon the length of discussion. Others require research and planning; therefore, they can be considered long-range in nature. The classroom teacher is best qualified to set the amount of time for these activities. There are also activities designed to be done at home and follow-up provided in the classroom.

CONCEPTS AND OBJECTIVES IN ENERGY CONSERVATION

Grade 6 - Packet "A"

Energy

1.00 The learner recognizes the limits of energy sources.

1.1 Becomes aware of what sources of energy cannot be reused.

1.2 Recognizes the difference between renewable and non-renewable energy sources.

1.3 Understands the relationship between life-style and energy resources.

1.4 Recognizes that economic factors limit energy development and use.

1.5 Sees that dependence upon one energy source is limiting.

Personal Accommodation

2.00 The learner will develop a conservation ethic in regard to energy.

2.1 Recognizes that every decision made involving energy affects standards of living.

2.2 Becomes aware of how social pressures to have things and use energy are created.

2.21 Becomes aware of the effect of the bias of media advertising and peer pressures.

2.3 Realizes that individuals may band together to effect choices in the social, economic, and political realms.

2.4 Acquires experience in making decisions and accepting the consequences of the decisions.

2.5 Expresses personal value that is received from energy conservation.

2.6 Chooses activities which will utilize energy conservation in making contributions to the school and community.

2.7 Investigates methods concerned citizens use to improve the future of energy solutions.

2.8 Develops an idea of the type of life-style desired in consideration of the amount of energy required.

2.9 Explores the selection of life-styles if energy conservation is not practiced.

ENERGY ACTIVITIES
Grade 6 - Packet "A"

1.00 The learner recognizes the limits of energy sources.

Non-Renewable Energy Sources

1.1 Students prepare a display of renewable and non-renewable energy resources. Encourage research and have students provide real samples whenever possible.

1.1 Students prepare reports on why the various types of fossil fuels are non-renewable.

1.1, 2.9 The students write short stories explaining what the earth will be like in the year 2000 in terms of energy resources. How will they travel from place to place? How will their homes be heated? What types of jobs will be available in the field of energy?

Difference Between Renewable and Non-Renewable Energy Resources

1.2 Use *Master #1*, which is a scrambled word puzzle using examples of energy that cannot be reused. The students unscramble and then list the words. Use *Master #2* for review of energy terms.

1.2 Visit a reusable energy source. Then visit a non-renewable energy source. Describe each.

1.2 Use activities from the above section to emphasize the point that a difference does exist between renewable and non-renewable energy sources.

Life-Style and Energy

1.3 The class lists the natural resources needed to build an automobile and make it run. On a world map, mount a toy car at Detroit; then using different flags and yarns for each resource, pinpoint the primary sources of supply and connect to Detroit. How many countries are involved? What would happen if the major producers cut off the supply?

1.3 Make a collage of pictures showing your life-styles. Or make a banner with a symbol which represents your life-style.

1.3 Students write what their lives might be like in the year 2000 with respect to energy consumption.

Suggestions for "starters": (*Master #3*)

a. Imagine you are writing in your diary, "It is the first day of the year 2000, and it seems ages ago that I was in school. So much has happened." (Go on to explain.)

b. Imagine you are age 47 in the year 2000 and are writing to your son. "You have criticized me and my generation for the mess we have made of the world." (What else would you say?)

1.3 Credit: "The Energy Question: Problems and Alternatives," Intercom, September, 1973, p. 12-16.

Write stories describing a blackout, what caused it, how people reacted, what life was like, etc. Share these with the class. Use *Master #4* as a starter.

1.3 Have the class list their uses of electricity. These should be listed in order from necessary to unnecessary. Then let them describe their living conditions if they were to be without various uses of energy. From this discussion they could develop a scale from a level where they are unable to survive to a level of extreme luxury.

1.3 Have the class list 10 of their favorite possessions that are made from oil or gas. This would be an excellent time to review how oil and gas serve as raw materials in synthetic fibers, plastics, etc. Then discuss what might happen to the cost and availability of these items as oil and gas become even less available.

1.3, 2.8 Plan a diary for a weekend during which little "outside" energy would be used--no bus, car transportation, no heating/air conditioning, TV, phone. Parts of these diaries could be shared in class. (*Master #5*)

1.3 Describe the living conditions of an American farm family and a farm family in India. Include in the comparison working hours, lighting, education, water source, cooling, diet, recreation, transportation, family size, and relate the energy available to the individuals. (*Data Sheet #1*)

1.3 Describe and create ways in which energy can be used to beautify the surroundings.

Economic Factors and Energy

1.4 When a resource begins to become scarce, it is due in part to the difficulty of finding it, taking it out of the ground, processing it for use, and transporting it to market. Choose an energy resource and discuss what jobs might be created or eliminated as it becomes more scarce.

1.4 Have students contact various sources such as industries, utility companies, etc. in order to learn more about the flow of dollars spent on energy resources in your community.

1.4 Announce to the class that the government will allow each family only a certain number of gallons of gasoline per week for their cars, lawn mowers, etc. Discuss how putting limits on an energy resource could extend the useful life of a resource.

1.4 Write letters to engineers at auto production plants to find out whether they are designing cars with better gas mileage. Ask them how much better the gas mileage will be, whether the government is forcing them to do this, and when these cars will be ready?

1.4, 2.2 Students take the part of the directors of the electrical company when they are making the decision about whether or not to build a new atomic plant. They could contact utility companies and community organizations to get background material in planning a more realistic debate.

1.4, 2.2 Those not involved in the previous experience could choose a role-playing situation with various people involved in the decision making process about using atomic power rather than coal. Different possible positions could include the farmer who doesn't want to give up land for the new plant, a coal mine owner, an atomic power plant director, and a housewife that wants more power for her appliances.

Limited to Energy Sources

1.5 Invite a speaker from a local utility company to explain to the class about the manufacturers and suppliers on whom it depends.

1.5 Tell the class that local stores have all announced that due to a transportation strike there will be no more candy bars sold. This will last for quite some time. Have the class discuss what will happen to the supply presently in the stores, how the supply will be distributed, what will happen to the price, and then have them explain what they would be willing to do to get some of the available candy bars. Relate this to limits on energy sources and ask what they would be willing to do to get some of the energy source which is almost gone.

1.5 Make a list of industries and products which are now dependent upon fossil fuels that will not be able, in the future, to switch to other energy sources.

1.5 Show *Transparencies #1-4* to help students see a total picture of what is going on with energy in the world. Discuss and use wall maps too.

2.00 Personal Accommodation: Conservation Ethic

Energy Decisions and Standards of Living

2.1 Write letters to the major industries in your community. Write letters asking them to describe their approach to energy conservation.

2.1, 2.8 Use a tape recorder to ask family and friends what they have done to contribute to the solution of an energy shortage. Play back in class and discuss.

2.1 Student Reports--Values Clarification Activity

Distribute copies of *Master #7*. This exercise will help students in making value judgments. After the students have completed the sheet, discuss the ranking they have done.

Social Pressures and Energy

2.2 Have the class study magazine advertisements about energy and power. Then have them create ads from the positions:

a. Environmentalist

b. Mother Earth

c. Power Producer

d. Businessman

These ads could be presented to a group of parents. Ask the parents for their reactions, thus creating a discussion.

2.2 Invite a speaker from an environmental group, a government agency, and a local power company to talk about energy problems in the community. The students should prepare questions ahead of time for a question and answer period.

2.2 Values Sheets--Values Clarification Activity

Provide students with copies of the Values Sheets (*Masters #8, 9*). These are to be completed individually and handed in. They would serve as a form of evaluation as to the effect of a study of energy on the student's attitudes. These can be used as pre- and post-activities.

2.2 Values Continuum--Values Clarification Activity

The teacher identifies an issue (see suggestions, or make up your own) and draws a long line on the board. Then place the two polar positions and mark a series of points along the continuum. Say, "Between the end points there are many positions. I am going to whip quickly around the room and ask

you to tell me where you stand on this issue. Briefly describe your position without giving reasons. You may pass if you wish."

If clustering occurs, you may wish to have the students write the answers on a piece of paper and the teacher randomly selects a few to be placed on the board.

A discussion then takes place on the presented issue.

Suggestions

1. What should the U.S. attitude be toward energy sources in other countries?

   PURCHASE ALL ENERGY FROM OTHER COUNTRIES :::::::::::::: PURCHASE NO ENERGY FROM ANY COUNTRY

2. How much do you watch TV?

   BLURRY-EYED BILL-- Never Turns It Off :::::::::::::: NO-KNOB NED-- Never Turns It On

3. How do you feel about automobile transportation?

   AUTO-GO Use for Everything :::::::::::::::: AUTO-QUIT Use As Little As Possible

2.3 Divide the students into groups to study the energy problem. Have each group appoint a recorder, math consultant, and researchers. The recorder keeps accurate records of everything, the researchers inform the group of news items, TV broadcasts, and conduct surveys. The math consultants meet with the teacher to make certain they can work the problems and then make sure that each member of the group knows how to work the problems.

Survey: How many students have turned their home thermostats down to 68 degrees?

Assign rooms to each group and ask them to show their survey form to you before taking the survey.

Problem: Use the data from the survey to figure what percentage of the students had turned the heat down.

Example:

Room	Total Number of Students	Number Who Turned Down Heat	Percent
12	22	20	91

Making Decisions, Accepting Consequences

2.4, 2.5, 2.6 The class prepares a tape-slide show depicting energy conservation, future energy sources, limits to energy, or all. This could be presented to other grade levels, to parents, to interested groups in the community.

2.4, 2.8, 2.9 Announce to the class that an ordinance has been passed ordering all users of electric energy to reduce their use by one-half. The students should be ready to explain what they will choose to do without and why.

2.4 Percentage Questions--Values Clarification Activity

The teacher reads several percentage questions, one at a time, to the students. The students write down their own answer to each question. Once this has been completed, the teacher breaks the class into small groups to share and discuss their answers. After they spend a short time on discussion, they are to think for a minute about what they have just learned. Students volunteer to share their "I learned..." statements.

What percentage of:

1. time do you spend watching TV?
2. your free time do you spend reading books?
3. your lights at home are on most of the evening?
4. your family takes showers instead of baths?
5. your letters in the past month have been to encourage people to conserve?
6. your family is willing to recycle?
7. your family is willing to drive the car less?
8. the time your family drives the car is spent driving at, or under, the speed limit?

Personal Value

2.5, 2.7 Students write articles to the local newspaper as a result of establishing an energy conservation value. This is expressed in their articles as to what should and could be done.

2.5, 2.8, 2.9 Values Whips--Values Clarification Activity

The teacher poses a question to the class and allows a few moments for the students to think about their answers. The teacher then whips around the room calling upon the students to give their answers. These answers should be brief and to the point. Any student may wish to pass.

Questions

1. What does your family do together?
2. What would you do if you couldn't watch TV?
3. Is there something you have done lately to conserve energy? Are you proud of what you did?
4. How did you take a public stand on energy conservation recently?
5. How would your life change if you had no electricity?
6. Why can't we continue to use all the fossil fuel we want?
7. How has you family reduced its utility bill?

Life-Styles and Energy

2.8 Compare utility bills from several different households to have the students attempt to discover why one family may use more kilowatt-hours than does another.

2.8 Have the students pretend they are going on a camping trip 200 miles from home. The vacation is to last two weeks. They are to spend as little money as possible, spend as much time in the wilderness as possible, and contribute as little pollution as they can. Provide students with a copy of *Data Sheet #2* on which they will select their mode of travel, cooking fuel, housing enroute, housing at the camp-site, types of activities at camp.

2.9 Students interview their parents and report back on how the family's use of the automobile has changed due to a decrease in the amount of energy available.

2.9 Distribute copies of *Master #10* and ask the students to study the list of habits. Announce that they will have the choice of doing this activity alone or with their family. Once the list has been studied, they should make an agreement with themselves (or the family does) describing precisely how they will handle the habit. After one week's time the class can share progress. This could conceivably become an on-going activity in which a new agreement is formed once the first is completed.

NON-RENEWABLE ENERGY SOURCES

Scrambled Word Puzzle

The following scrambled words are names for non-renewable energy sources. Unscramble them and write the words in the blanks.

1. ACLO _____
2. SAG LAURNTA _____
3. LECRTEITYIC _____
4. LIO _____
5. MTEPRUOEL _____
6. LISFOS SEFUL _____

Energy Activities
Grade 6
Packet "A"
Master #2
1.2

ENERGY PUZZLE

C	O	N	S	E	R	V	A	T	I	O	N
U	S	R	E	C	Y	C	L	E	T	R	G
T	K	I	L	O	W	A	T	T	S	B	E
E	P	O	E	F	A	D	M	H	C	L	O
R	N	A	C	G	T	H	S	E	D	I	T
A	U	E	T	H	E	S	W	R	Q	G	H
T	C	V	R	V	R	S	D	M	F	H	E
I	L	N	I	G	C	F	O	A	A	T	R
O	E	Q	C	T	Y	O	R	L	O	N	M
N	A	M	I	W	U	S	U	N	A	C	A
I	R	E	T	E	X	S	S	J	K	R	L
N	L	P	Y	A	C	I	P	S	M	I	T
G	O	K	I	R	O	L	A	F	A	S	E
S	H	O	R	T	A	G	E	L	N	I	R
B	V	I	U	H	L	Z	B	O	U	S	N
L	G	L	D	R	C	S	F	W	R	L	A
P	E	N	V	I	R	O	N	M	E	N	T
V	I	H	F	V	H	U	R	U	D	O	I
W	O	O	D	E	J	R	F	P	E	M	V
J	O	Y	K	R	O	C	E	A	N	Q	E
D	S	Z	M	O	H	E	A	T	I	G	C

Find these words in the puzzle.

sun
crisis
wood
coal
gas
oil
geothermal
tides
wind
electricity
source
kilowatt
water
energy
solar
nuclear
thermal
recycle
environment
rationing
shortage
fuel
conservation
fossil
flow
manure
earth
heat
light
alternative
food
river
man
ocean

FUTURE LIFE STYLES

Choose one of the following situations and write about it. Be creative and use your imagination--but also remember to use what you have learned about energy.

Situation #1

Imagine you are writing in your diary. "It is the first day of the year 2000, and it seems ages ago that I was in school. So much has happened since then." (Go on to explain.)

Situation #2

Imagine you are age 47 in the year 2000 and are writing to your son. "You have criticized me and my generation for the mess we have made of the world." (What else would you say?)

WHAT HAPPENED

You have just come home from school. You turn on the radio, but nothing happens. You check the cord. No problem there, it's plugged in. Then you notice the clock has stopped. You check around the house and discover there is no electricity. A blackout. It has affected the whole neighborhood, the whole city. There is no indication of when the power will be restored. It may be off for days.

(Write a story describing what happened to cause it and how people reacted. What was life like?)

Energy Activities
Grade 6
Packet "A"
Master #5
1.3, 2.8

MY WEEKEND DIARY

In your diary, tell what you have done each day during the weekend. Remember, there is no bus, no car transportation, no heating or air conditioning, no TV, no phone. A diary is for keeping record of things you have done and feelings you have.

Friday

Saturday

Sunday

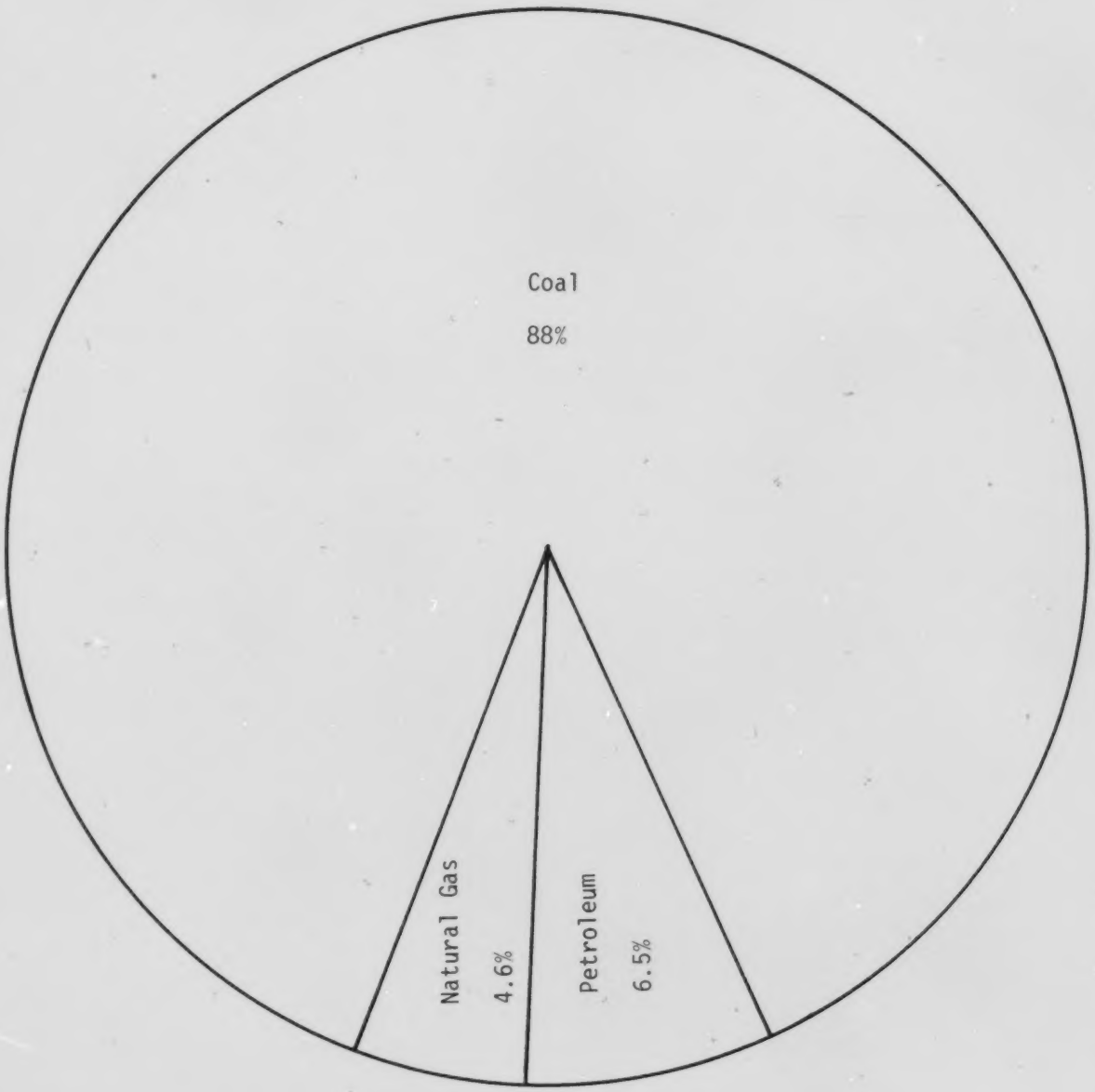
Energy Activities
Grade 6
Packet "A"
Data Sheet #1
1.3

ENERGY AND LIVING CONDITIONS

	American Farm Family	Indian Farm Family
Working Hours		
Type of Lighting		
Education		
Water Source		
Diet		
Recreation		
Family Transportation		
Family Size		
Medical and Dental Care		
Energy Available		

Energy Activities
Grade 6
Packet "A"
Transparency #1
1.5

WORLD SUPPLY OF FOSSIL FUEL



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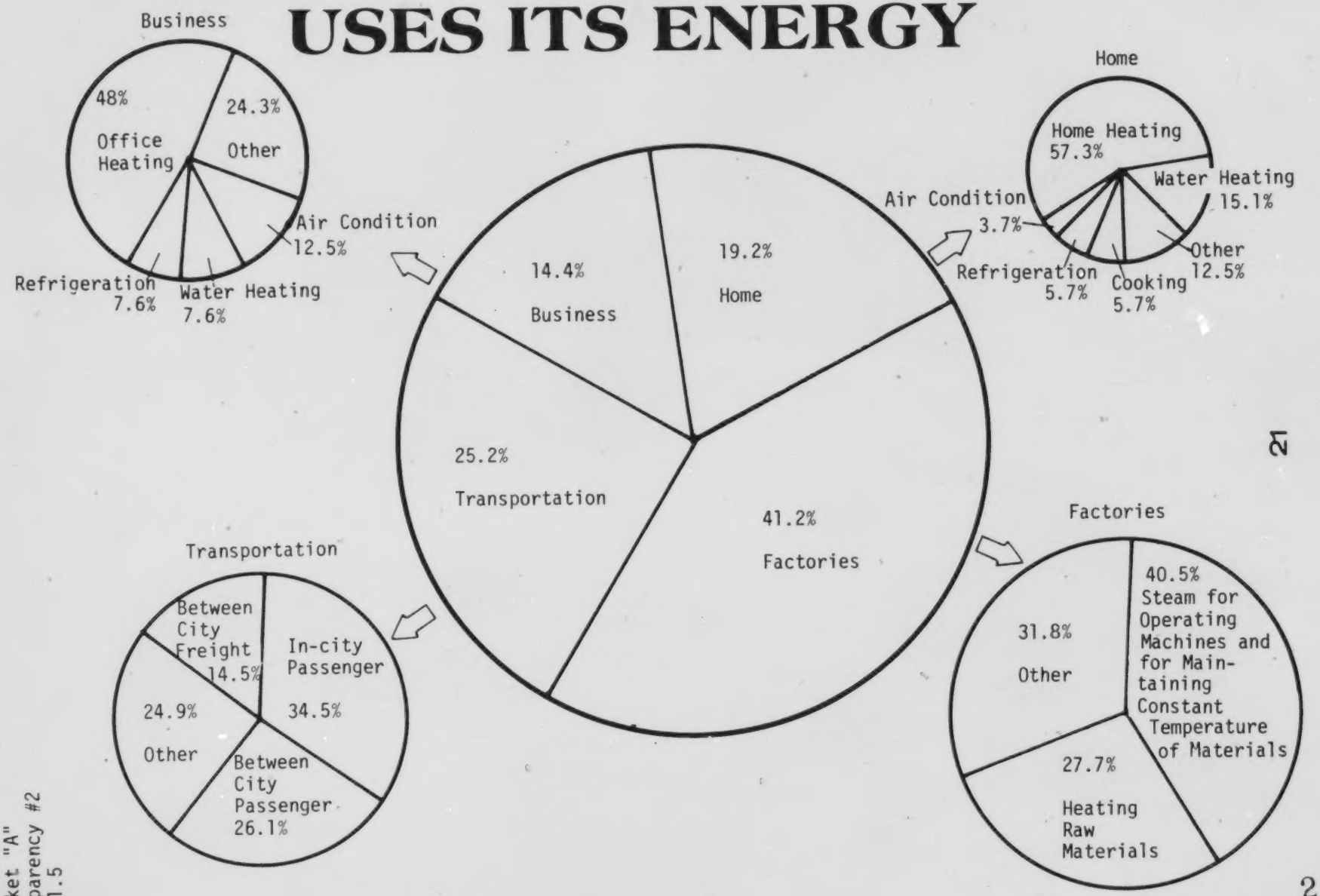
WAYS THE UNITED STATES USES ITS ENERGY



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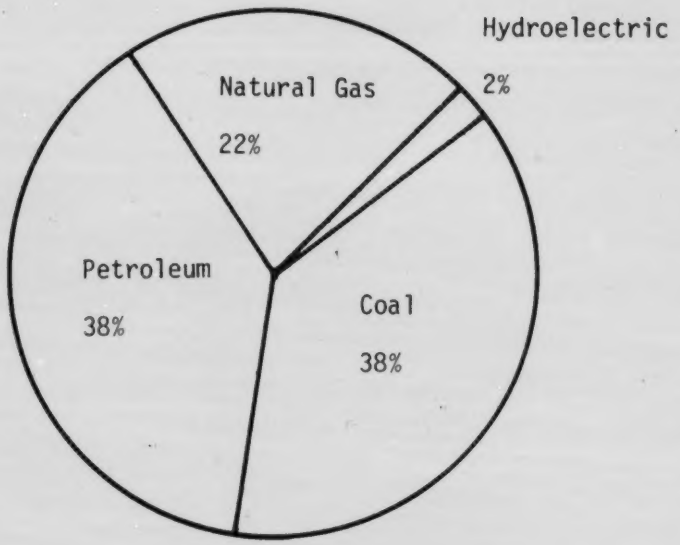
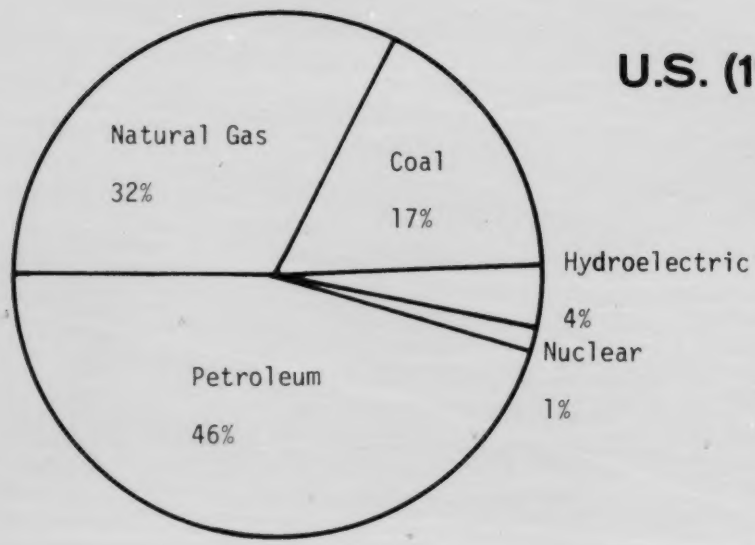
Energy Activities
Grade 6
Packet "A"
Transparency #2
1.5

WHERE DO WE GET OUR ENERGY?

World (1968)



U.S. (1972)



TYPICAL ELECTRIC BILLS, 1976

The Federal Power Commission has issued their 42nd annual report, *Typical Electric Bills*. The book lists every community of 2500 or more in the United States and reports the average bill for five different consumption levels.

An analysis of the forty-eight contiguous States and the District of Columbia (based on a monthly consumption of 500 kilowatt hours (kWh)) reveals that: New York had the highest average bill ($29.87), Washington had the lowest average bill ($7.58), Oklahoma had the largest increase in average bills (approximately 26.5%), and seven states had actual decreases in average bills, with Pennsylvania having the greatest decrease at 5.9%.

Below are listed the utilities with the highest and lowest typical monthly bills (500 kWh consumption) in communities of 50,000 population and more.

PRIVATELY-OWNED UTILITIES

Utility	Highest Bill	Utility	Lowest Bill
Consolidated Edison Co. of New York, Inc.	$36.64	The Washington Water Power Co.	$ 8.36
Western Massachusetts Electric Co.	26.74	Louisiana Power and Light Co.	10.63
Public Service Electric and Gas Co.	26.73	Puget Sound Power and Light Co.	10.64
New Bedford Gas and Edison Light Co.	24.90	Portland General Electric Co.	10.90
The Connecticut Light and Power Co.	24.74	Oklahoma Gas and Electric Co.	11.24

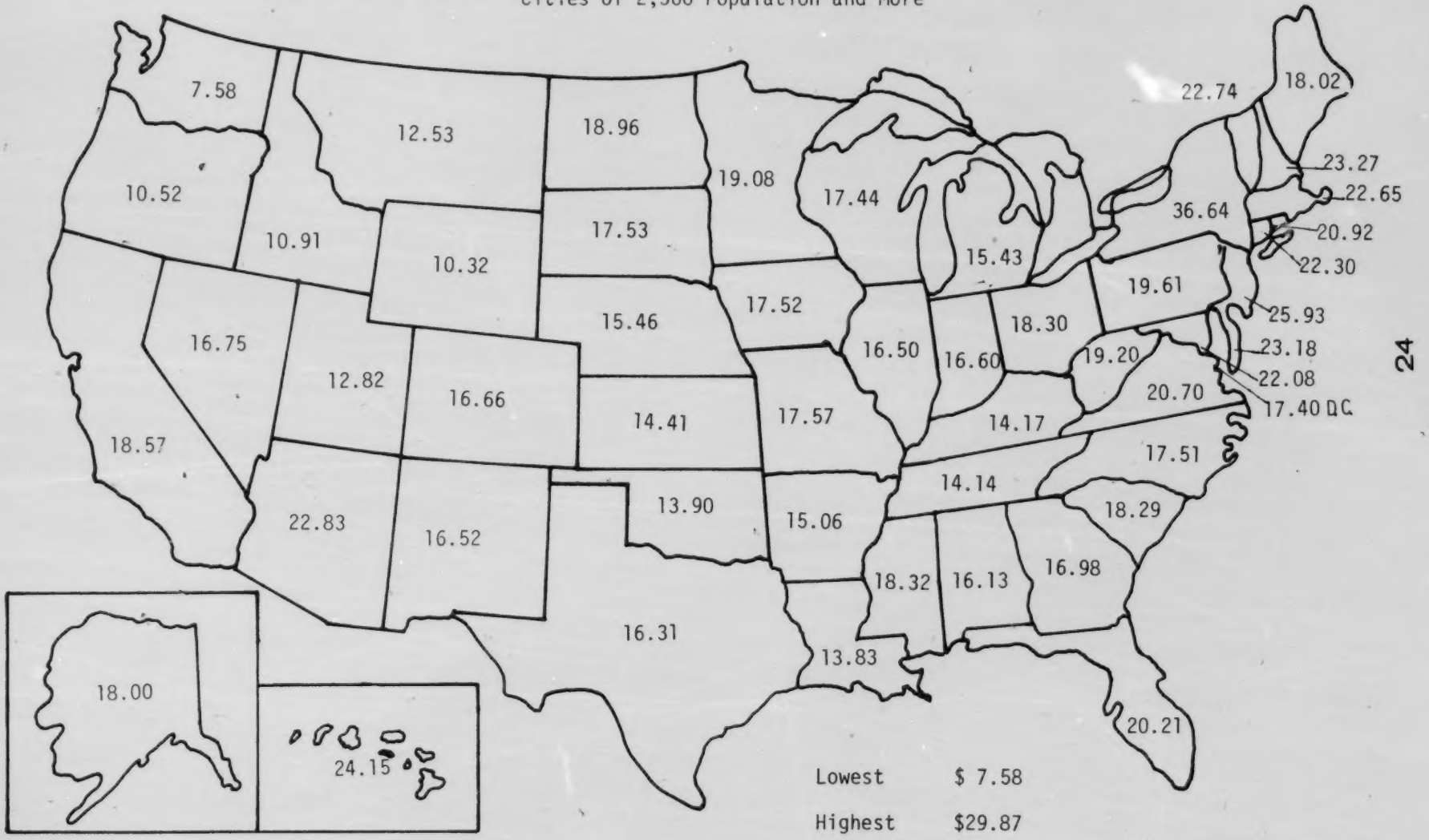
PUBLICLY-OWNED UTILITIES

Utility	Highest Bill	Utility	Lowest Bill
Austin (Tex.) Electric Department, City of	$25.44	Seattle (Wash.) Department of Lighting	$ 5.42
Brownsville (Tex.) Public Utilities Board	23.23	PUD No. 1 Snohomish County (Wash.)	5.72
Pasadena (Calif.) Light and Power Department	23.00	Salem Electric	5.85
Salt River PAL Power District (Ariz.)	22.83	Tacoma (Wash.) Dept. of Public Utilities	8.05
Tallahassee (Fla.), City of	22.23	Provo (Utah) City Corporation	8.30

STATE AVERAGE MONTHLY BILLS* - 500 KWH RESIDENTIAL SERVICE - JAN. 1, 1976

United States Average Bill - $19.26

Cities of 2,500 Population and More



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STUDENT REPORTS

Choose one of the following men of science who worked on some kind of energy:

Isaac Watt	E. O. Lawrence	Enrico Fermi
Michael Faraday	John Cockcroft	Ernest Rutherford
Albert Einstein	Lise Meitner	Benjamin Franklin

If you know of another one you may use that is not on the list, please check it with your teacher.

Your report should consider the following questions:

a. What was there in the life of the man you have chosen that interested you?

b. For what things did you admire him most?

c. What exactly did he achieve?

d. What difficulties did he have to undergo to achieve his goals?

e. Where did he make his greatest contribution?

f. Who benefited from this contribution?

g. Are the benefits still present today?

VALUE JUDGEMENTS RANK ORDER

Which of the following do you consider to be the most important?
Use the spaces at the bottom, and the scale, to rank the statements.

Scale: 1 = most important
9 = least important

a. Pure water

b. Clean air

c. Lower noise levels

d. Conservation of natural resources

e. Living an environmental life-style

f. Elimination of litter

g. Wise buying practices

h. Use less energy

i. Be aware of the environment

1. _____ 5. _____ 9. _____

2. _____ 6. _____

3. _____ 7. _____

4. _____ 8. _____

VALUES SHEET

Name _____

It is estimated that the aluminum industry uses 7% of the nation's total energy. Recycling of aluminum requires only 5% as much energy as must be used to produce aluminum from its ore.

1. What does this statement say to you?

2. Do you buy soft drinks in bottles or in cans?

3. In what ways do you try to recycle the aluminum cans you buy?

4. How important is it to you to recycle things?

5. If you plan to make any changes in your ways, please say what changes you will make. If you do not intend to make any changes, write "No Changes."

VALUES SHEET

Name _____

A car weighing 5,000 pounds uses over twice as much fuel as one weighing 2,000 pounds. Accessories such as air conditioning and automatic transmission contribute to fuel consumption.

The average car driven at 75 to 80 mph will consume twice as much fuel as the same car driven at 50 mph.

1. How do these two statements make you feel about the size of your family car and the speed at which it is driven?

2. What can you do about the size of your family car?

3. What can you do about the speed at which your family's car is driven?

4. How important is it to you that people drive smaller cars and drive slower?

5. What are some of the other things which could be done to save energy in transportation?

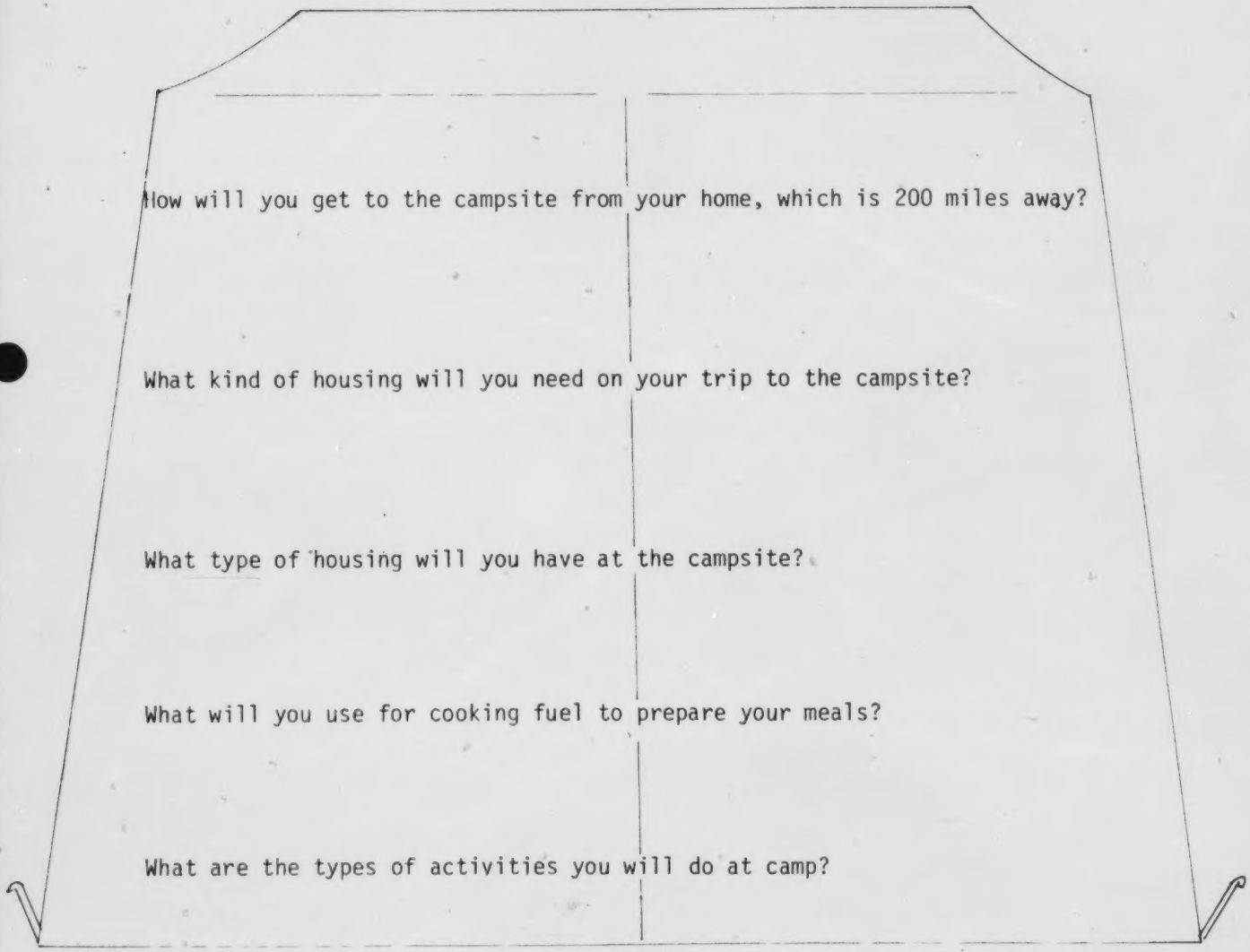
6. What are you going to do to help others realize the problems?

ENJOY THE WILDERNESS!

DON'T POLLUTE!

SAVE MONEY!

CAMPING TRIP



How will you get to the campsite from your home, which is 200 miles away?

What kind of housing will you need on your trip to the campsite?

What type of housing will you have at the campsite?

What will you use for cooking fuel to prepare your meals?

What are the types of activities you will do at camp?

ENERGY HABITS

Evaluate your habits. Then make a contract with yourself regarding one of the habits. If you wish, have your family make the contract so everyone will work on it.

1. Avoid buying aerosol cans.
   - dangerous
   - 16% of the cost for the product goes for the container
2. Buy all-aluminum cans.
3. Use and reuse each piece of aluminum foil before recycling it.
4. Buy only returnable bottles and return them.
5. Reuse glass jars.
6. Do not accept plastic bags at the grocery story or at the dry cleaners.
7. Return styrofoam egg and meat containers to the stores where you purchased the items.
8. Do not buy frozen foods in plastic cooking pouches.
9. Take your own shopping bags to the store.
10. Write on both sides of paper.
11. Use cloth napkins, towels.
12. Do not throw away leftovers. Use for lunches or add to pet food.
13. Use cloth handkerchiefs.
14. Reuse wax paper liners in cereal boxes for wrapping other items.
15. Save and bundle newspapers.

ENERGY CONSERVATION ACTIVITY PACKETS

GRADE 6

PACKET "B"

TEACHER BACKGROUND MATERIAL
Grade 6 - Packet "B"

It has been estimated that the average American uses the following energy resources each day: 13.6 pounds of coal, 3.3 gallons of oil, 297 cubic feet of natural gas, 2.7 kilowatt-hours of hydroelectric power, and .7 kilowatt-hours of nuclear power. In a lifetime, a person in the U.S. consumes 170 tons of coal, 2,000 barrels of oil, and 7.5 million cubic feet of natural gas.

If you had lived in the year 1900, you would have used only 25% of the energy you use today. In the year 2000 you will use almost twice as much as you use today if demand continues at the present rate. Additional energy sources exist, but require research for practical development and implementation, and that requires time and money.

The time has arrived for an energy transition, but this one will be unlike the two the U.S. has previously experienced. After the Civil War, coal replaced wood, windmills, and waterwheels. In the 1950's, oil and natural gas replaced coal. These transitions were not the result of shortages as the present one will be. If we act now to conserve our present energy resources and to develop additional energy sources the transition can be orderly. If delays arise too frequently and voluntary cooperation does not occur, more drastic measures such as rationing, etc. will be enacted to conserve our present energy resources.

a. Geothermal energy is largely untapped and additional research is needed to best determine how it will relieve the shortage. Geothermal heat is clean and much less expensive to use than fossil fuels. Sometimes, however, the steam contains objectionable gases. Most of the potential for geothermal energy in the U.S. is in California, Montana, and other western and Gulf Coast states. Reykjavik, the capital of Iceland, heats all of its buildings by natural hot water.

b. Water has long been a useful energy source; however, in the U.S. it is presently responsible for only about 15 percent of the total generating capacity. Investigation is being conducted to determine how feasible it is to extract large amounts of energy from ocean waves. Dams have already been built on the largest rivers to harness hydropower.

c. Shale deposits are mainly located in Colorado and Wyoming or government lands. Shale is a resource base for oil. High risks and high costs are involved in its development and these environmental and economic problems must be overcome.

d. Solar energy is an inexhaustible source of energy and is clean and renewable. About the only practical use of solar energy today is converting it to heat for space heating and domestic hot water heating. Experimental homes and buildings are already being studied to test how solar energy can efficiently be used to heat them. Research projects of this nature have been initiated in Iowa (i.e. Living History Farms, Raccoon Valley State Bank, Scattergood School in West Branch, Iowa). A long-term plan of the Energy Research and Development Administration is the development of commercially feasible ways to generate electricity directly from solar energy. Gerald Kline, head of the United States Department of Agriculture grain storage and drying research in Ames, is working to develop solar grain drying techniques.

e. Wind is a secondary form of solar energy. Wind power has been used for such mechanical tasks as pumping water, grinding grain, etc. since the time of the Romans. About 1900 the U.S. was utilizing wind energy for the very efficient clipper ships and windmills pumped water, generated electricity, and sawed wood. Fossil fuels were then found to be a more consistent, easily obtainable source of power but these have become very expensive as supplies dwindle. It has been estimated that the winds of the continental United States have about five times the total of our average power demand. Generally, the Great Plains and Northeast States have winds with enough strength (over 7 mph) to be of value. The major obstacle in using wind energy is its variability. Scientists still have much to learn about the most efficient equipment and the wind's behavior before the windmill returns to the scene.

f. Basically there are two types of nuclear activity being used or considered to supply energy. Nuclear fission is the breaking apart of the nucleus of atoms of uranium, thorium, or plutonium. The chain reaction which is required in this process is difficult to control. Only 1% of our total energy comes from nuclear powered plants. Nuclear fusion is the bonding together of very light nuclei, such as hydrogen or helium. Scientists are still working to harness nuclear fusion. The technological implementation of nuclear power is expensive and the environment needs to be protected from radioactive wastes, thermal pollution, explosion, and radioactive leaks.

g. Organic wastes have been gaining more attention as the U.S. disposes of millions of tons of organic wastes. Until recently, little attempt has been made to return these wastes to the soil or convert them. Some of these waste materials can be converted to methanol, methane gas, or burned directly as solids.

Some of the activities in the 6th grade packet require between 20 and 40 minutes depending upon the length of discussion. Others require research and planning; therefore they can be considered long-range in nature. The classroom teacher is best qualified to set the amount of time for these activities. There are also activities designed to be done at home and follow-up provided in the classroom.

CONCEPTS AND OBJECTIVES IN ENERGY CONSERVATION

Grade 6 - Packet "B"

Energy

1.00 The learner develops an understanding of alternative methods of energy.

1.1 Identifies principal energy sources which may be available in the future.

1.2 Becomes aware of energy flows.

1.3 Recognizes that energy availability will affect future life-styles.

Personal Accommodation

2.00 The learner will develop a conservation ethic in regard to energy.

2.1 Recognizes that every decision made involving energy affects standards of living.

2.2 Becomes aware of how social pressures to have things and use energy are created.

2.21 Becomes aware of the effect of the bias of media advertising and peer pressures.

2.3 Realizes that individuals may band together to effect choices in the social, economic, and political realms.

2.4 Acquires experience in making decisions and accepting the consequences of the decisions.

2.5 Expresses personal value that is received from energy conservation.

2.6 Chooses activities which will utilize energy conservation in making contributions to the school and community.

2.7 Investigates methods concerned citizens use to improve the future of energy solutions.

2.8 Develops an idea of the type of life-style desired in consideration of the amount of energy required.

2.9 Explores the selection of life-styles if energy conservation is not practiced.

ENERGY ACTIVITIES
Grade 6 - Packet "B"

1.00 The learner develops an understanding of alternative methods of energy.

Future Energy Sources

1.1 Credit: A Teacher's Handbook on Energy, Colorado Department of Education, Denver, Colorado 80203.

Have the class list 15-20 pairs of alternative ways of doing things commonly found in our way of life, such as the following:

a. Dishwasher vs. doing dishes in the sink

b. Fan vs. air conditioner

c. Power mower vs. hand mower

d. Electric razor vs. blade razor

e. Bath vs. shower

f. Gas stove vs. electric stove

g. Electric sweeper vs. broom

h. Automobile vs. bicycle

Ask the students, working in pairs, to select one of the alternatives and to compare/contrast the amount of energy used and the benefits received from the alternative they have selected. Encourage the students to think seriously about the advantages of both alternatives. Ask each pair of students to identify to the class the alternative they prefer and see if the class supports or does not support their choice.

1.1 Show pictures (*Filmstrip #2*) of wind, geothermal, solar, solid waste, etc. as future sources of energy to stimulate interest and to prepare for the next activity.

1.1 Students prepare reports and displays of potential energy sources which may be available in the future.

Geothermal	Hydrogen
Wind	Nuclear Fission
Tides	Nuclear Fusion
Coal Gasification	Solar
Sewage	Garbage--Solid Waste

Use the following issues of the National Geographic Magazine for information and pictures: November, 1972, "The Search for Tomorrow's Power," pp. 650-681; March, 1976, "Solar Energy, the Ultimate Powerhouse," pp. 381-397; and December, 1975, "New Energy from an Old Source: The Wind," pp. 812-829.

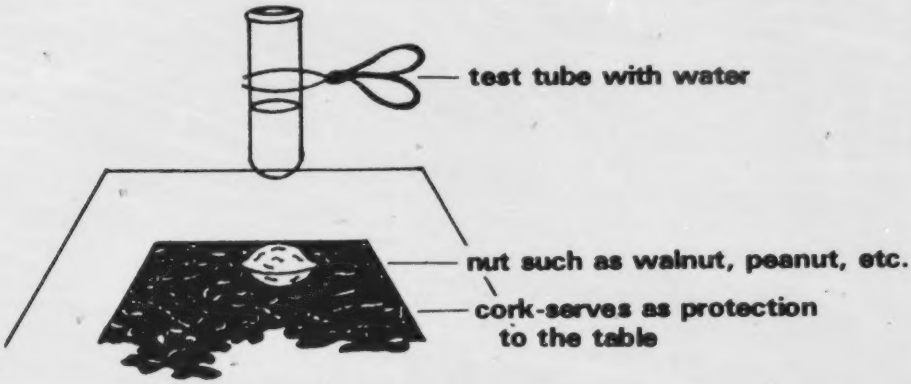
1.1 Students attempt to design and build models of possible future energy producing devices--especially in the areas of wind, water, solar.

1.1 Demonstrate the heating effect of sunlight. Put a pan of water in the sun and a similar pan with the same amount in the shade. Compare the temperatures. Discuss, "How can this heat be used?"

1.1 Remove the handle from an old umbrella, line the inside of the umbrella with aluminum foil, and point it at the sun. Concentrate the focused energy on a beaker of water and describe the result. Solar cookers built with concave mirrors can roast meat and some very large solar furnaces will give temperatures so high they can boil iron. *Experiment Sheet #1* could be used if there is interest or could be used in a learning station.

Solar cells have been developed that capture solar energy and convert it into electricity. This can be used right away or stored in batteries.

1.1 Storage of solar energy in plant materials can be demonstrated by burning a nut and measuring the rise in temperature of water. Students may then wish to research other ways energy is stored.



1.1 Make sun tea. Use cold water and tea bags in a jar. Put the lid on tightly and place in the sun. Watch the color in order to tell when it is ready.

1.1 If possible, visit a nearby home or other building which uses solar energy for heating purposes. Make a list of questions you could ask and do some research or background reading in preparation for your trip. Allow time for follow-up discussion and activities upon your return to the classroom.

1.1 Locate pictures of nuclear electric generating plants. Identify the purpose for each of the major structures.

1.1 Each student selects the source of electric power they think will be most used in the future. Information should be found to substantiate the choices. If possible, have them identify the economic aspects of the energy source.

Flow of Energy

1.2 Energy cannot be recycled because it is neither created nor destroyed. Energy is not consumed but changed in form. Use *Transparency #1, 2* to aid in explanation and discussion.

1.2 The class lists household items which can be used again. Then have them check the items that his or her family recycles. Finally, the class can list the items in the order of their recycling frequency. To make this activity more meaningful, have each student select a product (i.e. paper bag) and record the number of times you use it.

1.2 Visit a bottling plant and find out what the company is doing about recycling. If it is not possible to visit one, write a letter. Discuss methods and costs of recycling in contrast to throw-away containers (*Transparency #3*).

1.2 Take time to review with the class that people can save energy when they do not waste things. Whenever a thing is wasted, the energy that went into the production of it is wasted. Each time a person wastes food, paper, water, paper towels, etc. they are wasting energy.

Help the class develop a list of things that are often wasted in their homes. In addition to the items mentioned above, it will also include other common products and items such as electricity, gas, soap, hot water, etc. Use *Data Sheet #1* and have the students plan to record on the chart daily for one week their personal scores on saving or wasting. Each time they do something that saves energy they are to give themselves a plus (+) and each time they waste energy they are to give themselves a minus (-). At the end of the week discuss. Where did they save the most energy? When was it most difficult to save energy? Were they successful in changing wasteful habits? Did they notice a change in other members of the family?

1.2 Bring the following materials in order that the class may experience the recycling of paper:

newspapers
mixing bowl
egg beater
wood block
window screen (3-4 inches square)
plastic sandwich bag
wallpaper paste or corn starch
water
tablespoon

Now follow the directions (*Master #1*).

1. Fill the bowl one-fourth full of water.

2. Tear one-half of a newspaper page into pieces and put into the bowl to soak for an hour.

3. After it is soaked, beat it with an egg beater (beat until creamy).

4. Dissolve two heaping tablespoons of the wallpaper paste or corn starch in a pint of water, then pour into the bowl and stir.

5. Hold the piece of window screen flat and lower it into the pulp in the bowl. Repeat this until you have a layer of pulp about one-tenth of an inch thick.

6. Set the screen on a newspaper and place the plastic sandwich bag over it. Press down with the wood block--first gently and then with more pressure.

7. Allow the fibers to dry for about 24 hours. Then peel the fiber, then the paper from the screen.

Discuss with the class what fuel furnishes the energy for the process in a plant. Have them find out how the cost of recycled paper compares with the cost of paper from virgin timber. Ask the students to check in stores while shopping with their parents, to find how many articles are made of recycled paper. How can they help to recycle paper?

1.3 Have the students compare car advertisements of today with those of five or six years ago. What did car manufacturers stress then? Now? How do the differences relate to the energy crisis?

1.3 Discuss whether garbage utilities might be able to cut costs by requiring the householders to separate cans, bottles, and burnable trash. Contact the garbage utility and find out whether this has been considered, if it will save energy and money, and whether they plan to try this in the near future.

1.3 Divide the class into groups and ask each group to list the characteristics of a life-style they think would be most satisfying. From these lists, combine and arrive at a list of characteristics of the "good life." Then have the groups meet again to design a life-style which uses as little energy as possible and uses as many of the characteristics from the class list as possible.

1.3 Announce to the class that gas is permanently rationed to five gallons per week per family. The class then discusses which of their present habits will be changed due to the gas rationing.

1.3 Students suggest several alternatives to the prospect of a permanent gasoline shortage. The students then select one of the alternatives and prepare to define the choice to the class.

Possible alternatives might include:

1. rationing one automobile per family

2. no government interference

3. raising gas prices (taxing gas)

1.3 List 10 ways you can directly use less energy in your daily life. List 10 direct energy uses which make life more enjoyable for you. Discuss both lists as a class.

2.00 Personal Accommodation: Conservation Ethic

Standards of Living and Energy

2.1 Discuss whether happiness is equated with energy--considering luxuries. What would you be willing to give up right now?

2.1, 2.8, 2.9 List, in order, your uses of electricity from necessary to unnecessary. Let the students describe their living conditions without various uses of energy. Then have them develop a scale from a level where they are able to survive to a level of extreme luxury.

2.1, 2.9 Students construct a model society that contains the "good life." Then use this model to make judgments about resource use, but remember to consider self and others.

2.1, 2.8 Credit: The University of the State of New York, The State Education Department. Living Within Our Means: Energy and Scarcity, Environmental Education Instructional Activities, K-6.

To develop an awareness of the impact of inventions on our economy, have pairs of students research the lives and inventions of such men as Eli Whitney, Cyrus McCormick, Thomas Edison, Alexander Graham Bell, Andrew Carnegie, Henry Ford, the Wright Brothers, and others. One of the students researches the inventor's personal life while the other examines how the economy and society was affected by the individual's accomplishment. (Master #2)

In the presentation to the class, the one narrates the personal struggles of the inventor with emphasis on obstacles, discoveries, and effects on his life. The other describes how work, travel, communication, and industry were changed and lists the products, conveniences, and economic advantages generated by the invention.

After the presentations, consider the following questions for discussion:

a. As a result of these inventions, what natural resources became more valuable and important?

b. How did these inventions create millions of new jobs or businesses?

c. What new problems were created as a result of these inventions?

d. Why must man carefully examine what effect a new invention will have on his environment?

e. Why shouldn't low cost and convenience be the only consideration man uses in determining the worth of new machines?

f. What rules would you make before allowing a new invention to be marketed or used? Why?

Social Pressures and Energy

2.2 Collect and display advertisements illustrating methods industry has used to implement energy conservation policies. Discuss and react to them.

2.2, 2.7 Learn about legislation which is being proposed or adopted regarding the energy situation. Find out what legislation has been passed and what is being proposed so there will be both mandatory and voluntary conservation. Write letters to your legislators and congressmen.

2.2, 2.4, 2.5, 2.7 Form an energy saving committee to warn others of energy misuse and waste. This committee could be helpful in the school by talking to other classes and it could also set up an information booth in a public place.

2.3, 2.7 Write to organizations requesting energy materials (American Association of University Women, League of Women Voters, CURE, etc.). Compare the positions taken by two or more of these groups concerning a given controversy. How do they agree? How are their views different?

Making Decisions, Accepting Consequences

2.4, 2.8, 2.9 Distribute copies of *Master #3*. Give them an opportunity to circle those things they could do adequately in their homes without electricity. Then ask the students to explain how they would accomplish those things without electricity.

2.4, 2.5, 2.6, 2.7 Design posters or write newspaper editorials to convince people of the importance of planning ahead to insure adequate usable energy sources for the future.

2.4, 2.5, 2.6, 2.7 Hold an energy education fair where student-prepared models and charts are displayed. They could also present a media show using student-made slides, films, and tapes.

Activities in Energy Conservation

2.6 Alternatives Search--Values Clarification Activity

Provide each student with a copy of the chart (*Master #4*) and present the students with the following values issue, or one of the additional suggestions. Each student brainstorms as many alternatives as he or she can think of in 3-5 minutes. Then they should check the appropriate column for each alternative. They may share thoughts with the class if they wish.

Values Issue
Ways to Conserve Energy

Additional Suggestions

1. Future energy sources
2. Ways to help our school conserve energy
3. Ways to help our family conserve energy
4. Ways to make our voices heard on the energy problem

2.6 Consequences Search--Values Clarification Activity

This is used as an activity after the Alternatives Search. It is just as important to evaluate consequences as it is to search for alternatives.

Provide each student with a copy of *Master #5*. At the top they are to place the three most feasible solutions to the energy shortages. Then, for each of the alternatives, they are to list as many possible consequences as they can think of. This may be done individually or in small groups. After considering the consequences, they should re-evaluate their positions. This could mean a re-ranking of the alternatives.

Methods to Improve Energy Solutions

2.7 After a visit to a local county government or city council meeting, explain the process by which a concerned citizen gets his energy concerns discussed by local decision makers. The students develop a graph or picture to show the process.

2.7 Write articles or letters for the newspaper (school and/or local), letters to legislators and congressmen, letters to the mayor, governor, president, etc. These would show the result of establishing a conservation value.

2.8 Students could become citizens of a model community. First have them list what they consider to be problems of their existing community. They could also collect magazine and newspaper articles concerned with problems.

Announce that each student is to consider himself a citizen of a future and totally new community. Let the class discuss how they would want this new community to be different from the present one. This could include which problems they would like to see solved, begin to think of a name for the community, and consider how they could solve some of the energy problems of today so their new community would not experience these.

Research needs to be done on energy sources so encourage students to: talk with parents; invite plumbers, heating contractors, representatives of oil, gas, coal, and electric industries in the community; take trips to local mine, refinery, and generating plant. Then plan a community meeting for the purpose of sharing information and deciding which one source of energy to use for heating and cooling homes.

2.9 Have the class list restraints that might result from overpopulation.

2.9 Have the class describe what the quality of life might be like under severely restricted energy resource conditions. They might enjoy making drawings or even a mural.

2.9 Credit: A Teacher's Handbook on Energy, Colorado Department of Education, 1974. Show *Transparencies #4-7* and discuss the attitudes toward energy.

ENERGY ALTERNATIVES
OR
FUTURE SOURCES OF ENERGY

Grade 6

Packet "B" Filmstrip #2

#1 Energy demand is outstripping supply. We must face the fact that soon some fuels will be gone. Research must develop efficient and clean sources of energy.

#2 Wind power is one of the world's oldest energy systems and currently is being re-examined for feasibility and efficiency. Wind has been replaced by other sources of energy which are more dependable and more economically reasonable. Wind blows nearly always and nearly everywhere.

#3 The darkest tints on this map indicate where the greatest wind energy potentials are located. These are areas that have powerful winds part of the time. As an example, 2 cities have identical average wind speeds, but City A's winds blow 8.2 mph for half of each day and 14.2 mph for the other half. During their windier half day, City B has as much energy available as City A would have during the whole day. In short, we could say a little more wind means a lot more power.

#4 Experimental wind power machines were built between 1935 and 1955, primarily in Europe, but were discarded, usually for economic reasons.

This Danish Gedser Mill Wind Turbine was developed after World War II. Tied into the existing public utility network, with a 200 kilowatt rated power output at 33.6 mph wind speed, it operated successfully until the early 1960's when the cost of electricity by wind power proved to be twice the equivalent fuel cost of steam.

#5 The world's largest windmill was an experimental wind turbine generator called the Smith-Putnam machine. It was built in 1941 at Grandpa's Knob near Rutland, Vermont. During the 1940's it fed electricity into local power lines, but the project was abandoned in 1945 when one of the eight-ton blades tore loose. These two blades spanned 175 feet and the generator pumped enough power for perhaps 200 homes.

#6 Experimental designs are still being developed. The Energy Research and Development Administration (ERDA) experimental 100-kilowatt propeller type windmill near Sandusky, Ohio, starts to generate electricity in 8 mph winds and reaches full power in 18 mph winds. This huge experimental generator

was designed by National Aeronautics and Space Administration and is mounted on a 100-foot tower. The rotor has two aluminum blades, each 62½ feet long. The system is being tested as a possible prototype for practical commercial machines. The Experimental Wind-Turbine Generator could possibly supply 30 homes with power.

#7 Vertical axis wind turbines are now undergoing tests in Albuquerque, New Mexico. Curved airfoil blades in a vertical position can accept wind from any direction, and rotors at the top and bottom set the turbine in motion even at low wind speeds.

#8 The wind, however, is not the only inexhaustible source of energy available. We also must look to the sun to help solve our energy needs. The sunshine that falls on Connecticut roughly equals the total energy used in all 50 states. Harnessing the sun's energy remains a major problem. However, steps are being taken to overcome this problem. Already the sun's energy has been put to use on a small scale to provide space and hot water heating in homes and buildings all over the world.

Rooftop solar heaters are most commonly used. This solar home in Colorado utilizes a liquid system with panels by Revere Copper.

#9 Solar heating systems require storage for heat collected during sunny days for use at night and in overcast weather. Insulated tanks for heat storage can be placed above or below ground and can store heat in water or in rock beds.

The Donald Suttons of Ogden, Iowa, utilize a rock storage bed.

#10 The Living History Farms near Des Moines, Iowa, will be constructing a single-family farm using the sun for its power and solar pond for storing heat.

#11 The sun's light may be converted directly into electric power by semi-conducting devices called photovoltaic cells.

#12 People also have begun to take an interest in resource recovery as an energy source. One of the most advanced and complete resource recovery systems has been built by the city of Ames, Iowa.

#13 In 1975, the Ames Solid Waste Recovery Plant began using combustible refuse in the coal-fired boilers at the city-owned electrical power plant.

#14 Solid waste comes from Ames, Iowa State University, and several other communities. The wastes pass through two stages where they are first shredded to one-half inch size.

#15 Ferrous metals, aluminum, glass, sand and grit are removed. The wastes which remain are taken by conveyor to the power plant to be used.

#16 Nuclear power plants burn a fuel just as conventional power plants do. The difference is in the fuel used. Nuclear power plants commonly use uranium-235, which occurs in nature. One piece of uranium fuel the size of a golf ball has the energy equivalent of 168,000 gallons of oil. The only commercial nuclear energy generating facility operating in Iowa is the Duane Arnold Energy Center near Palo, Iowa. This plant, along with others, is based on uranium fission which is the splitting of the nuclei.

#17 The nuclear fuel cycle begins with the uranium being mined and the ore milled to produce a concentrate. A conversion plant purifies the uranium and converts it to uranium hexafluoride (UF_6). At the enrichment plant the gaseous UF_6 is enriched and stored. The enriched UF_6 is converted into uranium dioxide, made into pellets, loaned into tubing, and made into fuel element bundles. These go to the nuclear power reactor and are used to produce electricity. Spent fuel is removed and stored in cooling tanks before being shipped in heavy lead casks. Plutonium is stored for possible future use as a fuel. Radioactive wastes will be shipped to a Federal Waste Repository and low-level wastes are buried.

Another type of nuclear energy - fusion - is being demonstrated and tested, but it has not been developed sufficiently for commercial application. Fusion is a process of combining the nuclei of light elements to produce heat. Its most important feature is that its fuel is derived from water.

#18 The rise and fall of the tides rotates turbines to generate electricity. With the use of gates and pool areas, water can be held in readiness for a peak demand time. In the U.S. there are a number of possible sites, varying in potential of perhaps 2,000 to 20,000,000 kilowatts each. The Pasamaquadi Tidal Power Project off the Maine Coast has been in the discussion stages since the 1920's, but no actual construction has taken place due to high costs of development and alternative supplies which are readily available. The only large-scale tidal project in actual operation is one on the Rance River in France with a capacity of 240,000 kilowatts.

#19 One energy source we cannot overlook is geothermal power, the heat from within the earth. Geothermal power is not expected to become a major source of energy in the near future, but it is not to be pushed aside.

#20 At the present time electrical power is being produced at the Geysers in northern California. Steam is collected, filtered and passed through turbines that drive electric generators. Geothermal energy also may be used for household heating and industrial processes.

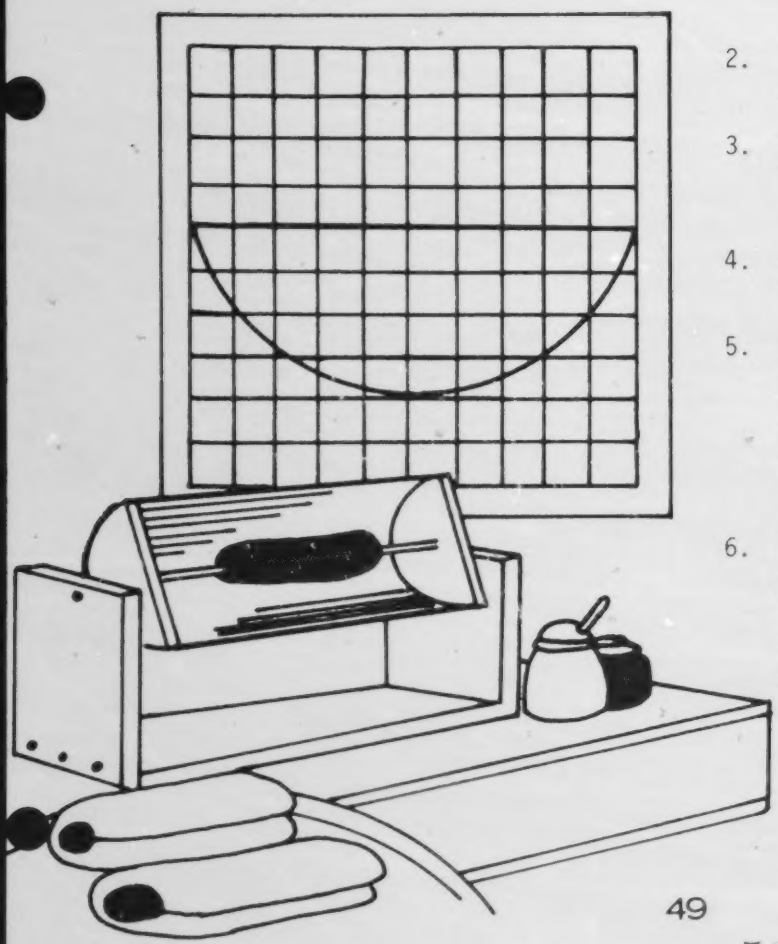
It is essential that we continue to explore new methods so that our energy needs will be met without damaging the environment.

Energy Activities
Grade 6
Packet "B"
Experiment Sheet #1

SOLAR HOT DOG COOKER

Experiment taken from Energy Conservation: Experiments You Can Do, Thomas Alva Edison Foundation, Inc., 1974.

Materials: piece of 1 x 8 lumber 4 ft. long, 1 ft. wide by 2 ft. long sheet of aluminum (the kind sold in hardware and lumber stores), 2 four-inch nails, handful of short nails, two wood screws about 2 inches long, two metal washers to fit the screws, pad of steel wool, tube of household cement, shiny aluminum foil, large piece of brown wrapping paper and pencil, yardstick or ruler, hot dogs, tin snips



1. Draw a grid of one-inch squares on the wrapping paper. The grid should contain 100 squares and measure 10 inches by 10 inches.
2. Draw on the grid the pattern and be ACCURATE!
3. Cut out the pattern, lay it on the piece of wood next to one end and trace it.
4. Make a second one just like the first.
5. Use a wood saw to cut out the two side pieces. Then cut a 12 1/4 inch piece of wood for the base and two 8 1/4 inch pieces of wood for the side supports.
6. Nail the piece of aluminum to the side panels to make a type of aluminum-bottomed "canoe." Cut off the excess metal with tin snips.

7. Use the steel wool to polish the inner surface of the aluminum and wipe off. Apply a layer of household cement to the surface and cover with a piece of aluminum foil cut to fit inside the "canoe." (shiny side out!)

8. Look at the sketch. Drill one hole in the center of the upper portion of each side panel.

9. Push the long nails into the holes and secure with a small amount of cement. Polish the nails with steel wool and rinse with water.

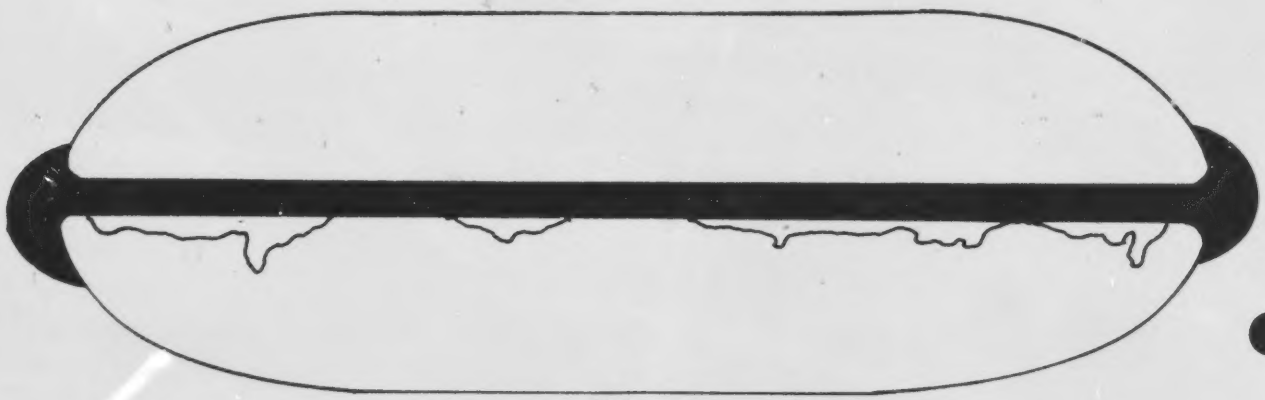
10. Nail the base and side supports together.

11. Drill a hole near the top of each side support.

12. Use the wood screws and washers to mount the "canoe" on the support stand.

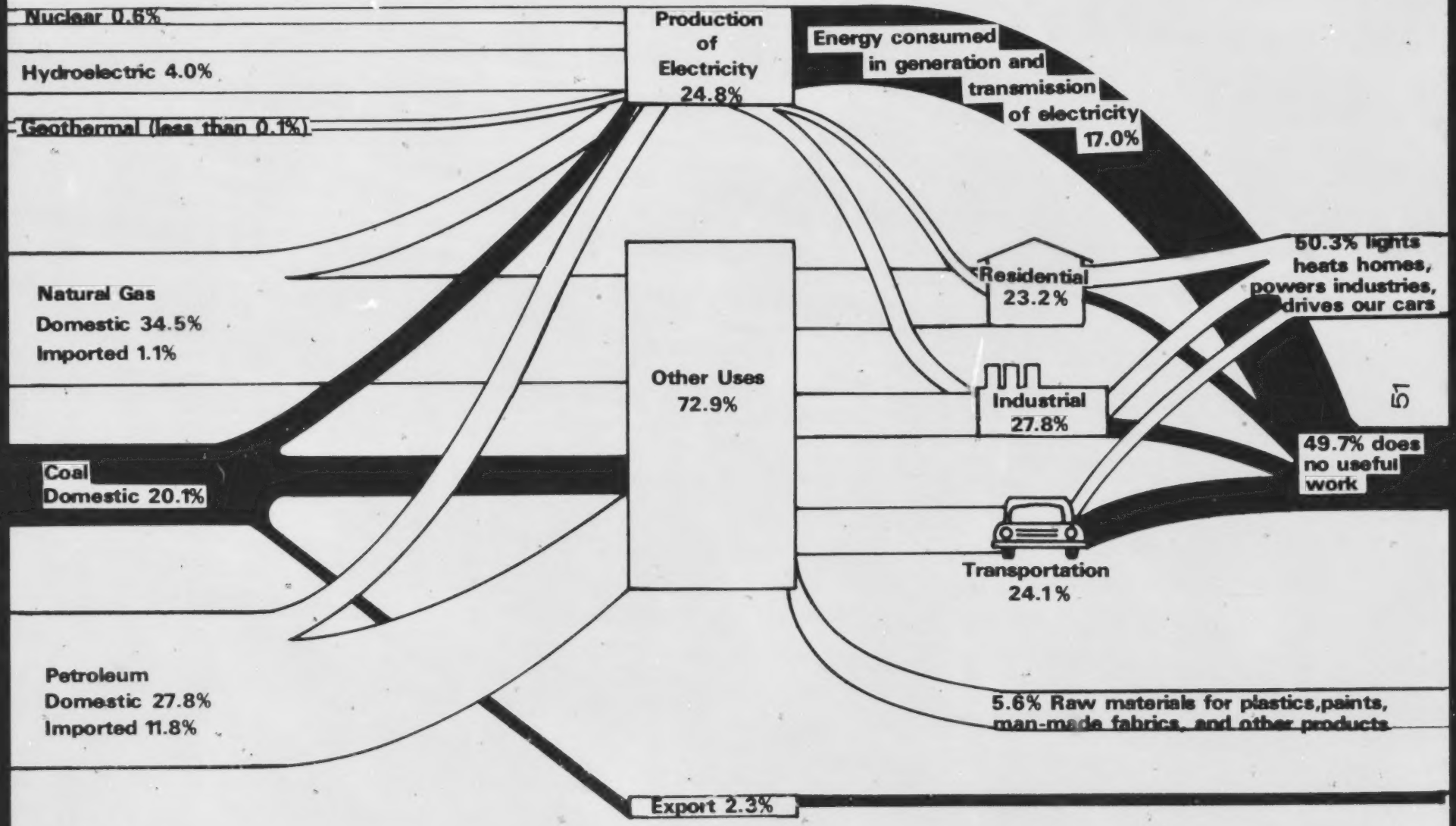
13. Skewer a hot dog on the two long nails, point the cooker toward the sun. It takes a minute or two of strong sunlight to prepare the hot dog.

14. Use a fork to remove the hot dog as the nails get hot.

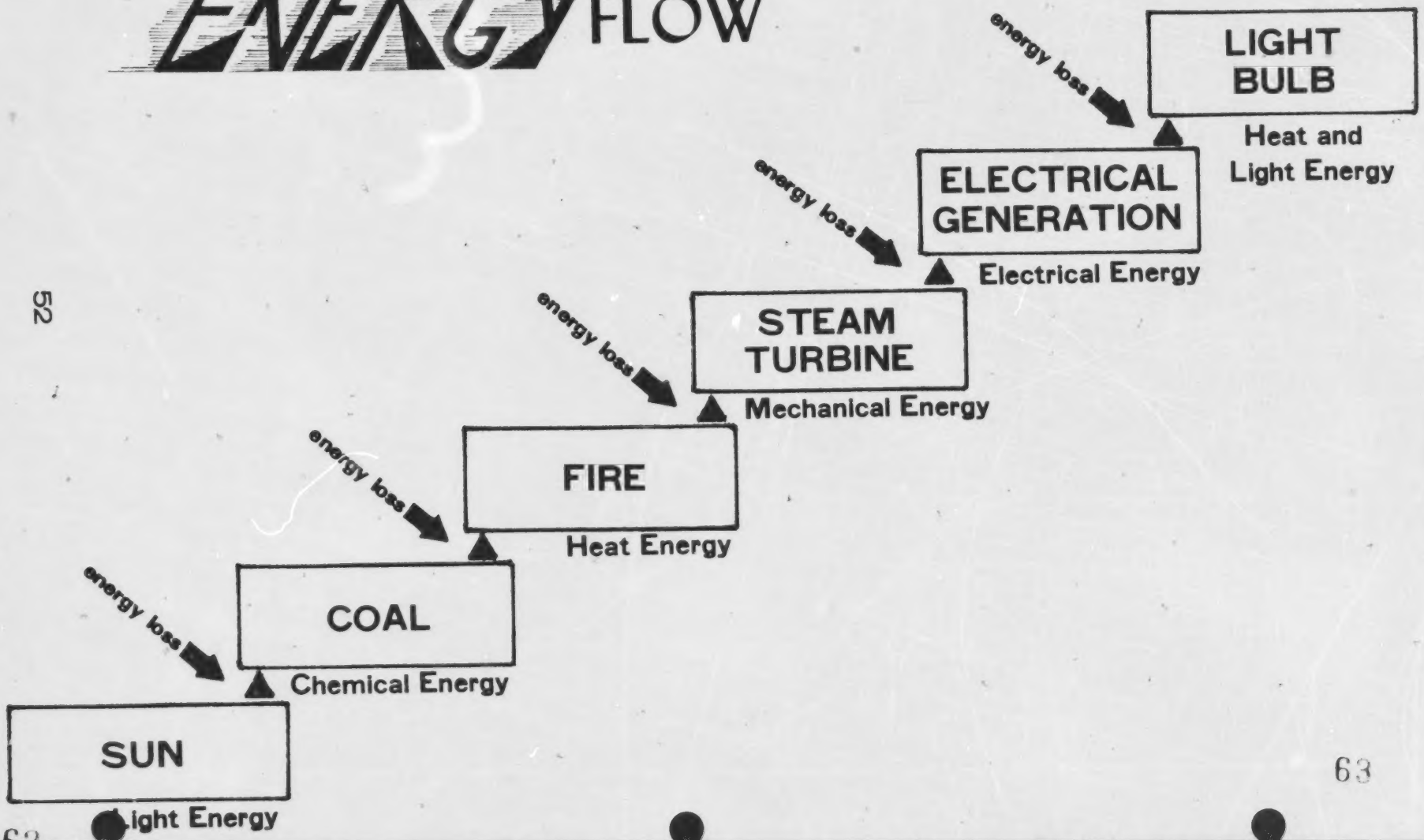


Energy Activities
Grade 6
Packet "B"
Transparency #1
1.2

U.S. ENERGY FLOW CHART



ENERGY FLOW


LIGHT BULB
Heat and Light Energy
energy loss
ELECTRICAL GENERATION
Electrical Energy
energy loss
STEAM TURBINE
Mechanical Energy
energy loss
FIRE
Heat Energy
energy loss
COAL
Chemical Energy
energy loss
SUN
Light Energy

Do Returnable Bottles $ave

The purchase of a six-pack of soft drinks in returnable bottles instead of no-deposit no-return containers will save the energy equivalent of .25 liters of gasoline. The saving of 0.25 liters of gasoline can take the average family car about 2 1/2 miles. In addition, when the empty bottles are returned for a 30-cent deposit, the six-pack purchase will have cost 18 cents less than for throw-aways.

1. If each family in the class purchased one or two six-packs of returnable bottles each week for one year, how much energy in gasoline will be saved?

2. Using the figure from #1, how many miles of automobile travel are possible with the energy which is saved?

3. How much money is saved?

4. Why do you think so many people still buy beverages in throw-away containers?

5. What do you think the government or people should do about this matter? What will you do?

Energy Activities
Grade 6
Packet "B"
Data Sheet #1
1.2

MY ENERGY INVENTORY

Name _____

Things often wasted in my home	Sun	Mon	Tues	Wed	Thurs	Fri	Sat
Food							
Pencils							
Paper Towels							

RECYCLING PAPER

Materials: newspapers, mixing bowl, egg beater, wood block, window screen (3-4 inches square), plastic sandwich bag, wallpaper paste or corn starch, water, tablespoon

Directions:

1. Fill the bowl one-fourth full of water.
2. Tear one half of a newspaper page into pieces and put into the bowl to soak for an hour.
3. After it is soaked, beat it with an egg beater until creamy.
4. Dissolve two heaping tablespoons of the wallpaper paste or corn starch in a pint of water, then pour into the bowl and stir.
5. Hold the piece of window screen flat and lower it into the pulp in the bowl. Repeat this until you have a layer of pulp about one-tenth of an inch thick.
6. Set the screen on a newspaper and place the plastic sandwich bag over it. Press down with the wood block--first gently then with more pressure.
7. Allow the fibers to dry for about 24 hours. Then peel the fiber, then the paper from the screen.

Energy Activities
Grade 6
Packet "B"
Master #2
2.1, 2.8

INVENTIONS AND ECONOMY

Choose another student as your partner to research the life and invention of one of the following men. You may wish to choose one not mentioned below.

Eli Whitney
Cyrus McCormick
Thomas Edison
Alexander Graham Bell
Andrew Carnegie
Henry Ford
Wright Brothers

One student describes the personal life of the inventor

OBSTACLES

DISCOVERIES

EFFECTS ON HIS LIFE

One student describes how WORK, TRAVEL, COMMUNICATION, INDUSTRY were changed by the invention. Include the products and conveniences which were a result of the invention.

CAN YOU DO WITHOUT ELECTRICITY

Which of the following could you do in your home without electricity? Circle those you feel you could do adequately. Be ready to explain how you would do them without electricity.

1. cooking
2. washing dishes
3. drying clothes
4. washing clothes
5. opening cans
6. storing food in summer
7. storing food in winter
8. lighting
9. keeping warm in the winter
10. keeping cool in the summer

ALTERNATIVES CHART

Alternative	I'll try it	I'll consider it	I won't try it

Energy Activities
Grade 6
Packet "B"
Master #5
2.6

CONSEQUENCES GRID

Alternative # 1	Alternative # 2	Alternative # 3

Energy Activities
Grade 6
Packet "B"
Transparency #4
2.9

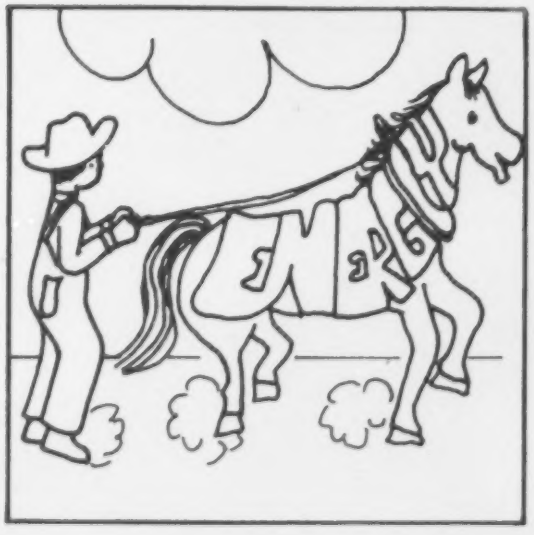
ATTITUDES TOWARD ENERGY

From A Teacher's Handbook on Energy, Colorado

No need to limit consumption of energy.

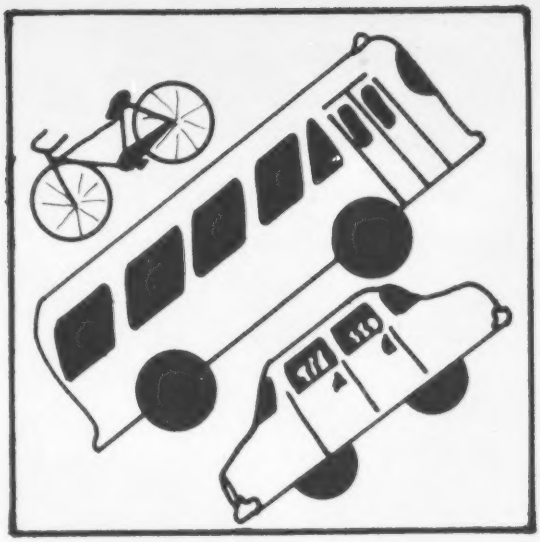
The quality of the natural environment is not affected by energy consumption.

If we cut back our energy consumption, we would be back to "cave man" days.

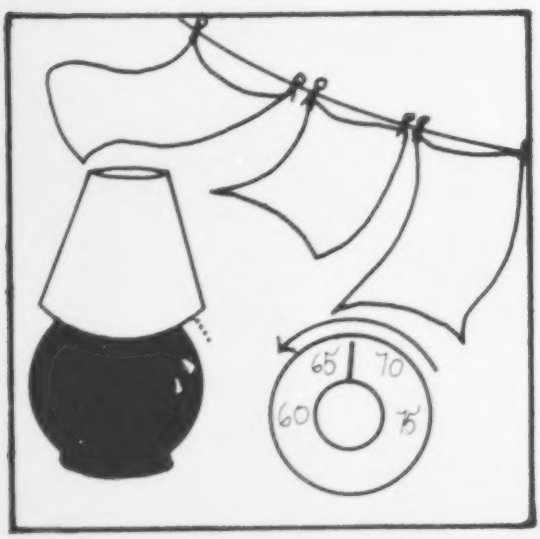


Man has the right to harness all the energy his technology permits. He has a right to use it for his own wants and needs.

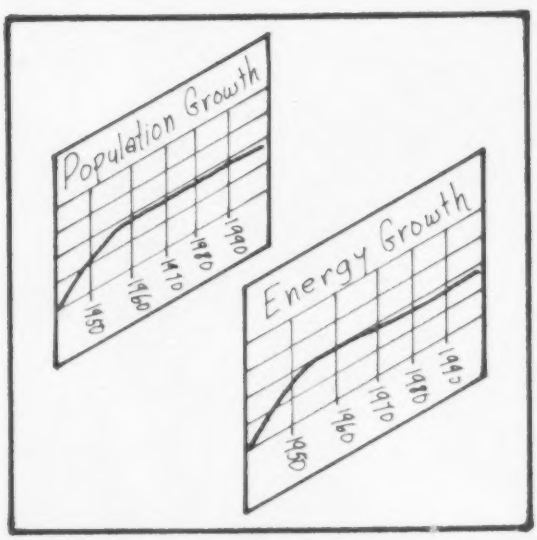
Energy is limited. We should use it carefully.



Energy consumption does affect the quality of the natural environment. We should be aware of ways to eliminate some energy use.

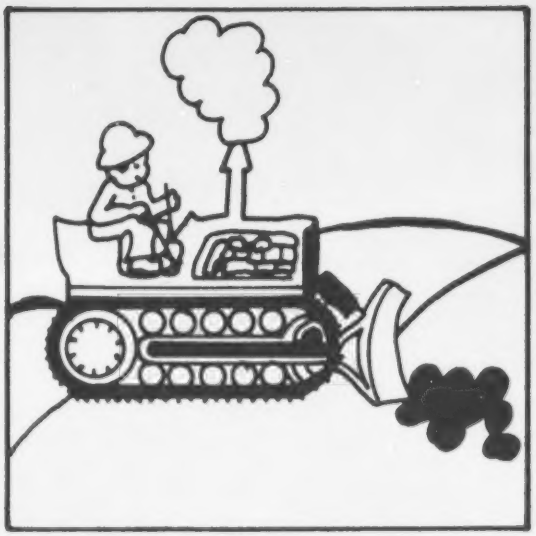


We can reduce energy consumption without returning to "caveman" days.



Man can live better with his environment if he conserves energy use and limits population.

There is nothing wrong with the people of the United States. They provide 6% of the world's population but use 30-40% of the world's natural resources.

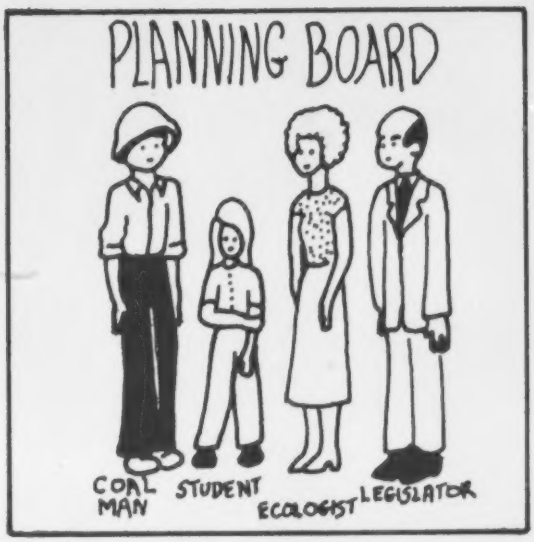


When you have extensive reserves of an energy source, harness it without reservation to help solve any energy shortage.

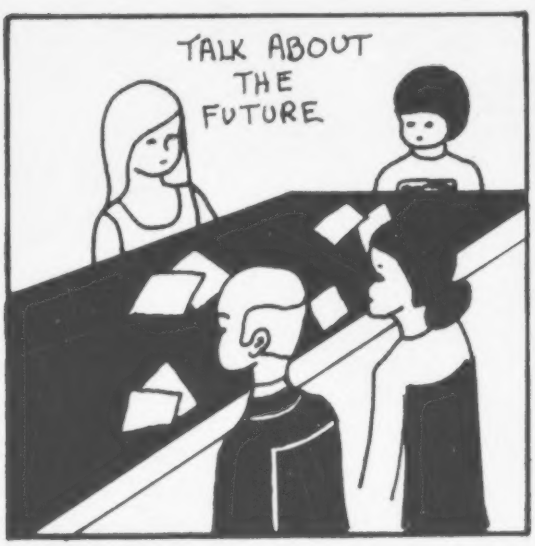
The quality of life in our generation is more important than generations of the future.

Question to ask yourself about use of energy: Will development provide *Me* with a higher standard of living?

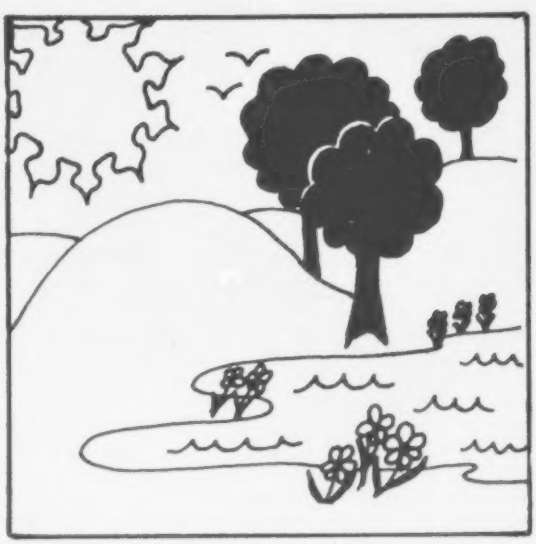
The people in the United States need to examine the world's picture of energy and need to make some changes in their use of energy.



Environmental impact of each energy resource development should be carefully considered.



We should think about future generations when we consider present use of resources.



The need for preserving clean air, clean water, and a healthy environment is more important than increasing your standard of living.

ANNOTATED CHILDREN'S BIBLIOGRAPHY
Grade 4-6

BOOKS AND PAMPHLETS

Adler, Irving
Atomic Energy
John Day Company, 1971, 47pp., $3.69

Explains why atomic energy may be the only answer to fuel for power in the future.

Adler, Irving and Ruth
Coal
John Day Company, 1965, 47pp., $3.96

Traces the development of coal, how it is mined, its uses, and its many by-products.

Adler, Irving
Energy
John Day Company, 1970, $3.96

Practical examples of changes from one form of energy to another.

Adler, Irving
Petroleum: Gas, Oil, and Asphalt
John Day Company: New York, 1975, 48pp., $5.95

Aimed more towards the science-oriented. It has concise coverage of the story of oil and gas. It includes definitions, formation, location, and extraction of petroleum.

Barr, Donald
How and Why Wonder Book of Atomic Energy
Grosset & Dunlap: New York, 1961, 48pp., $1.50

Tells the development of the atomic bomb. It also describes the steps taken to learn how to use controlled atomic energy for power.

Benrey, Ronald M.
Nuclear Experiments You Can Do
Thomas A. Edison Foundation, Inc.: Michigan, 1976

Booklet containing some basic facts about nuclear energy and related experiments. Designed to aid in the understanding of nuclear energy.

Energy Reprints from ERDA
Solar Energy

A folder of solar reprints from a variety of sources that provide ideas of what can be done to apply solar energy for use in the home.

Faber, Doris
Enrico Fermi: Atomic Power
Prentice Hall, 1966

Freeman, Mae & Ira
The Story of Electricity
Random House, 1961

Haber, Heinz
The Walt Disney Story of Our Friend the Atom
Simon and Schuster: New York, 1956, 165pp.

Explanation of atomic energy provided in a combination of story and fact.

Halacy, D.S., Jr.
The Energy Trap
Four Winds Press: New York, 1975, $6.95

Describes the energy crisis, its link to the gross national product, and alternatives for current and future fuel resources.

Halacy, Daniel Stephen
Experiments With Solar Energy
W.W. Norton and Company, Inc., 1969, $4.50

Selection of materials, approximate cost, the construction and operation of devices using solar energy.

Harrison, George Russell
The First Book of Energy
Franklin Watts, Inc.: New York, 1965, 77pp.

Words and illustrations explain what energy is, kinds of energy, how energy affects the economy of the world, and what mankind could do with more energy.

Hinkelbein, Albert
Energy and Power
Watts, 1971

Historical approach to energy. Various sources of energy are described. It suggests new ways of using energy and speculates on future supplies.

Iowa Energy Policy Council
Home Energy Conservation

Booklet filled with useful information to help consumers conserve energy.

Iowa Power
"Answers to Forty of the Most Commonly Asked Questions About Electricity"

Small pamphlet available from Iowa Power which states each question and then relates answers which are simply stated and easily understood.

Iowa Power
Be Energy Wise - It All Adds Up!

Booklet designed to help citizens review constructive and up-to-date ideas on how to conserve energy in the home.

Iowa Power
Dr. Wise Use Energy Diet

Booklet available to the public which contains the cost to run every appliance in a home, and some ideas to help consumers cut down energy use.

Irving, Robert
Energy and Power
Alfred A. Knopf: New York, 1958, 140pp.

Describes work, power of different types, sources of energy other than fuels, and energy of the future.

Kelman, Peter and A. Harris Stone
Ernest Rutherford: Architect of the Atom
Prentice Hall, 1969

Kiefer, Irene
Underground Furnaces: The Story of Geothermal Energy
William Morrow and Company, Inc.: New Jersey, $4.95

Easy but accurate explanations of how four kinds of "hot spots" are formed and how they can be transformed into usable energy.

Knight, David C.
Harnessing the Sun: The Story of Solar Energy
William Morrow and Company: New York, 1976, $5.95

Tells of past and present work in the field of solar energy and speculations on what may lie ahead.

Marshall, James
Going, Going, Gone?
Coward, McCann and Geoghegan, Inc.: New York, 1976, $5.49

Consideration is given to the waste of energy resources by Americans. Tells us how and why we allow waste to continue.

Mattison, C.W.
Man and His Resources in Today's World
Creative Educational Society: Mankato, Minnesota, 1967, 150pp., $6.95

Book on man's resources which is well illustrated. It emphasizes conservation and touches on pollution. Also includes future power resources.

Millard, Reed
Natural Resources: Will We Have Enough for Tomorrow's World?
Messner, 1972

Each chapter begins with a question relating to a specific natural resource and the possibility of their depletion. Also provides suggestions for further reading.

Moore, Jordan
Energy
Grosset & Dunlap: New York, 1967, 61pp.

Provides examples of many types or sources of energy and also experiments for a better understanding of what energy is.

National Dairy Council
How Your Body Uses Food
28pp., $.25 per copy

Graphic art, photographs, and text emcompassing easy, safe experiments with foods, challenge for growth, energy and health. The booklet can be useful in science, health, and nutritional studies.

National Wildlife Federation
The Best Present of All
National Wildlife Federation: Washington, D.C.

Comic brochure on energy for children.

Office of Conservation Education
Energy Conservation: Understanding and Activities for Young People
U.S. Government Printing Office: Washington, D.C. 20402
Stock No. 041-018-00091-7, 1975, $.85 per copy

Booklet written in language understandable for the upper elementary and junior high student. The material on energy, its uses, and conservation aids the student in his understanding. The suggested activities are interesting.

Podendorf, Illa
The True Book of Energy
Children's Press: Chicago, 1971

Book relates the importance and kinds of energy to children's own experiences. The book contains short sections and many illustrations.

Pringle, Laurence
Energy: Power for People
Macmillan Publishing Company, Inc.: New York, 1975, $6.95

Author urges young people to face the facts about the energy supplies of the earth.

TCI Advertising, Inc.
The Atom and the Energy Crunch
Reddy Communications, Inc., 1976

Available from Iowa Power. Booklet containing information on the energy crisis; what has caused it, nuclear energy, future energy sources.

TCI Advertising, Inc.
Coal and the Energy Crunch
Reddy Communications, Inc., 1976

Available from Iowa Power. Information on sources of coal, value as an energy source, problems due to use of coal, and the importance of planning ahead.

TCI Advertising, Inc.
Electric Utilities and the Energy Crunch
Reddy Communications, Inc., 1976

Available from Iowa Power. Information to aid in the understanding of where electricity comes from and why the supply of power is threatened.

Reuben, Gabriel H. and Joseph Di Stefano
What Is An Atom?
Benefic Press, 1960

Ross, Frank
The World of Power and Energy
Lothrop, Lee and Shepard, 1967, $4.32

Sun, sky, water, earth, fossil fuels, chemical and atomic energy. The book also concerns itself with energy from the depths of the earth.

Ruchlis, Gyman
Thank You, Mr. Sun
Harvey House Publishers: New York, 1966, 45pp.

Provides many illustrations of how the sun helps mankind and nature.

Shuttlesworth, Dorothy E. and Lee Ann Williams
Disappearing Energy
Doubleday and Company, Inc.: New York, 1974, 96pp., $5.95

Good resource book which presents factual data on the use and misuse of energy. Also reviews what has been done in regards to conservation but does not look into the possible future solutions.

Smith, Norman F.
Sun Power
Coward, McCann and Geoghegan, Inc.: New York, 1976, 46pp., $4.64

Everything that lives and grows on the earth uses energy from the sun. Gives a new understanding and appreciation of the sun, our chief energy source.

Syrocki, Ed.D.
What Is Electricity?
Benefic Press, 1960

Szulc, Tad
The Energy Crisis
Franklin Watts, Inc.: New York, 1974, 128pp., $6.95

Author reveals many disturbing items in relation to the energy crisis and why it is here. It also contains an explanation of why the energy crisis will continue into the future.

Thomas A. Edison Foundation, Inc.
Energy Conservation: Experiments You Can Do
Michigan, 1974, 32pp.

Booklet containing many energy conservation experiments designed to bring about a better understanding of how energy can be conserved at the present time.

Wohlrabe, Raymond A.
Exploring Solar Energy
The World Publishing Company, 1966, 89pp.

Identifies early history of sun worshipers, how the sun provides heat and light which can be turned into electricity. It also discusses the uses of solar energy for the future.

Zim, Herbert
Waves
Morrow, 1967, $3.78

Brief useful introduction of tidal waves and underwater earthquakes.

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Asimov, Isaac
Electricity and Man
U.S. Atomic Energy Commission
U.S. Government Printing Office, 1974

An informative booklet intended to aid citizens in understanding the vital force of nuclear energy. This and other information booklets, are available for the general public. School and public libraries may obtain a complete set without charge. Available from: USAEC - Technical Information Center, P.O. Box 62, Oak Ridge, Tennessee 37830.

Asimov, Isaac
Worlds Within Worlds: The Story of Nuclear Energy, Vol. 1, 2, 3
U.S. Energy Research and Development Administration

Three comprehensive booklets including atoms, electricity, and energy showing how man has learned to produce and control nuclear energy.

Cottrell, Frederick W.
Energy and Society: The Relation Between Energy, Social Change, and Economic Development
McGraw, 1955, 330pp., $15.00

Survey which examines the use of energy in low and high energy societies.

Daniels, Farington
Direct Use of the Sun's Energy
Ballantine Books: New York, 1974, 271pp., $1.95

Provides a review of the potential of solar energy and urges additional research. Fun and informative books which could also spark projects and solar experiments.

Energy Research and Development Administration
Creating Energy Choices for the Future
Office of Public Affairs: Washington, D.C. 20545, 1975

A booklet designed to improve the understanding of the U.S. energy policy.

Federal Energy Administration
Organizing School Energy Contests
Washington, D.C. 20461

Helpful brochure encouraging the formation of school energy contests. Guidelines are given as to the processes involved.

Federal Energy Administration
Tips for Energy Savers
Washington, D.C. 20461

Helpful booklet filled with many useful and simple ways to save energy. Designed for individuals and families, but also contains a teaching guide for teachers to help students bring these tips to the concern of the family.

(Ford Foundation Energy Policy Project)
A Time to Choose: America's Energy Future
Ballinger: Massachusetts, 1974, 511pp., $12.95

Final report of a three-year, $4 million study. Reflects the conviction that America can and should have a national energy policy that serves the needs of all people.

Fowler, John W.
Energy - Environment Source Book
National Science Teachers Association, 1975

Designed for teachers who wish to incorporate a study of energy into their teaching. It is divided into two volumes, each with many charts, tables, figures.

Fritsch, Albert J. and others
Energy and Food: Energy Used in Production, Processing, Delivery, and Marketing of Selected Food Items
Center for Science in the Public Interest, 1975, 80pp.

The authors suggest ways to reduce the input of energy in food processing.

Hammond, Allen L., William D. Metz and Thomas H. Maugh II
Energy and the Future
American Association for the Advancement of Science: Washington, D.C., 1973, 184pp., $3.95

Gives an introduction to each of the present and possible future energy sources. It also covers energy conservation and energy policy.

Halacy, D.S., Jr.
Wind, Sun, and Water: Our Energy Alternatives
Harper, 1977, 192pp., $9.95

Easily read. The renewable resources of geothermal, water, tidal, sea thermal energy, wind, biofuels, and solar energy are presented for consideration.

Hayes, Dennis
Energy: The Case for Conservation
Worldwatch Paper, 1976, 77pp.

Review of the economics of energy expenditures and contains many good charts and graphs.

Hodges, Laurent and John Neff
Solar Energy: 1976
Report from the Iowa Energy Policy Council, June, 1976

Descriptive report of some uses to which solar energy is being put and anticipation for further uses.

Iowa State Department of Public Instruction
Energy Conservation in School Facilities

Brochure designed to encourage energy conservation in school facilities. Specific recommendations for reducing energy waste are proposed.

Lapp, Ralph E.
The Nuclear Controversy
Fact Systems: Connecticut, 1974, 93pp.

Especially interesting to foes of nuclear fission.

Lemish, Dr. John
Mineral Deposits of Iowa
Iowa Southern Utilities Company
Craftsman Press, Inc.: Burlington, April, 1969

Excellent resource for Iowa teachers as it is a statement of the mineral deposits and their potentials in the state of Iowa. Some of the information can be condensed and revised for use with upper elementary students.

Miller, Roger LeRoy
The Economics of Energy: What Went Wrong?
Morrow, 1974, 131pp., $4.95

Short review which includes criticism of living the simple life and price controls.

Olin, Dr. Hubert L.
Coal Mining in Iowa
State Mining Board
State of Iowa: Des Moines, Iowa, 1965

Booklet which presents the early history of coal mining in Iowa, its importance as a resource of the state, and its role in the development of Iowa's economy.

Rocks, Lawrence and Richard P. Runyon
The Energy Crisis
Crown: New York, 1972, 189pp., $2.95

Review of sources of energy, impending crisis, resolutions for the problems the U.S. is presently facing.

Simmons, Henry
The Economics of America's Energy Future
U.S. Energy Research and Development Administration, Office of Public Affairs: Washington, D.C. 20545, 1975

Booklet which reviews the role of energy in American life, trends in energy supply, and highlights various forms of energy.

Steinhart, Carol and John Steinhart
The Fires of Culture: Energy Yesterday and Tomorrow
Duxbury, 1974, 273pp., $4.95

A general introduction to energy. Contains material on energy policy, energy and food.

Stolp, Richard N. and Frederick P. Deluca
Perspectives on Iowa Coal
Energy and Mineral Resources Research Institute, Iowa State University: Ames, Iowa 50011, 1976

Colorful and easily understood report on the Iowa Coal Research Project which provides information for interested Iowans.

Swatek, Paul
The User's Guide to the Protection of the Environment
Friends of the Earth, 1970, 305pp.

Paperback which provides specific information on daily decisions which could improve or deteriorate a person's environment. Packaging products, cleansers, energy consumption in the home, are examples of topics the book covers.

Tuthill, Dr. Samuel and Maurice Van Nostrand
Our Energy Needs: Questions and Answers
1973

Very helpful material regarding an energy shortage in the U.S., related in concise form. Helpful to Iowa teachers at all levels.

Udall, Steward and others
The Energy Balloon
McGraw, 1974, 288pp., $7.95

Author urges development of new attitudes and leaner life-styles in order that there will not be as much wastefulness.

U.S. Department of Commerce
Energy: Critical Choices Ahead
Office of Energy Programs, May, 1975

Brochure designed to put the energy problem into perspective and to give indications of the efforts required to meet energy needs.

U.S. Environmental Protection Agency
Questions and Answers About Nuclear Power Plants
U.S. Environmental Protection Agency: Washington, D.C., Revised, 1973

Pamphlet designed to answer many questions which have arisen concerning nuclear power plants and the environment.

ANNOTATED TEACHER'S BIBLIOGRAPHY

CURRICULUM GUIDES AND RESOURCE BOOKS

American Gas Association, Education Services, 1515 Wilson Boulevard, Arlington, Virginia 22209

Provides many booklets, pamphlets, kits, filmstrip on natural gas. Specifically for grade 5 you may be interested in "Natural Gas Serves Our Community Kit"--N00160 and "Flames and Energy"--N81070.

A Teacher's Introduction to Energy and Energy Conservation
Ohio Department of Education, 1975
Battelle Center for Improved Education, 505 King Avenue, Columbus, Ohio 43201 (ED 127 160)

Guidelines on energy and energy conservation. Provides teacher orientation to energy education and general suggestions for teaching units.

CEL Blocks
Primary Interdisciplinary Environmental Learning Packets,
Brevard County, Florida (ESEA Title III, Project #050-2323-73003)

Student cards covering areas of environmental education which can be used by teachers in a variety of interdisciplinary ways.

Energy
Environmental Education Project, ESEA Title III, Section 306
Topeka Public and Parochial Schools, 1601 Van Buren, Topeka, Kansas 66612 (ED 093 649)

Objectives are listed, along with activities which meet the stated objectives. Teachers select only those appropriate to the objectives for their students.

Energy
Michigan United Conservation Clubs, P.O. Box 30235, Lansing, Michigan 48909

Provides information on the nature of energy, sources and uses of energy, and conservation. There are also some work sheets and ideas for helping others learn more about energy.

Energy
Social Issues Resource Series, Eleanor C. Goldstein, c. 1975.
Social Issues Resource Series, Inc., 1200 Quince Orchard Boulevard, Gaithersburg, Maryland 20760

Notebook filled with reprints of articles related to energy.

The Energy Challenge
Federal Energy Administration
The Energy Challenge, Box 14306, Dayton, Ohio 45414

Twenty-five spirit duplicating activity masters designed for grades 5 through 8. Also contains a teacher's guide section.

Energy Conservation Classroom Kits 1-3, 4-6
Southern California Edison Company, c. 1976
Educational Services, Room 397, P.O. Box 800, Rosemead, California 91770

Colorful kits to help teachers teach about energy conservation. There are folders, inspector cards, stickers, certificates. The teacher's guide contains ideas and lesson plans, in addition to duplicating masters.

The Energy Crisis: What You Can Do About It
Standard Oil Company (Indiana), c. 1973
Mail Code 3705, 200 E. Randolph Drive, Chicago, Illinois 60601

Folder containing four spirit masters and specific teaching instructions. The spirit masters give information and ask for students to supply some interpretation. Parents and other adults are encouraged to participate.

Energy Crisis Teaching Resources
Curry, Wendell, et. al., Oregon State Board of Education, Salem, Oregon, 1973, 59 pp. (ED 085 316)

Many very useful activities to be used in stressing individual responsibility towards energy crisis problems.

Energy - Environment Materials Guide
Kathryn E. Mervine and Rebecca E. Cawley
National Science Teachers Association, Washington, D.C., 1975
(ED 111 663)

Handy source book containing annotated bibliographies for teachers, students, non-print material.

Energy - Environment Mini-Unit Guide
Smith, Stephen M., Editor, c. 1975
National Science Teachers Association, Washington, D.C. (ED 111 664)

Materials designed to stimulate decision making in young children and to make teaching more interdisciplinary. It is filled with many activities and guidelines.

Energy for Today and Tomorrow
San Diego City/County Schools Energy Education Committee
Department of Education, San Diego County, 6401 Linda Vista Road, San Diego, California 92111, 1975

Activities for students in grades kindergarten through six. These help to create an awareness of the need of dealing with energy problems.

Energy and Man's Environment
Jones, John, D.Ed., Editor, 1976
Energy and Man's Environment, Inc., 0224 S.W. Hamilton, Suite 301, Portland, Oregon 97201

Interdisciplinary teacher's guides to energy and environmental activities. Involves 8 books - Activity Guide, Uses of Energy, Sources of Energy, Impacts of Energy, Limits of Energy, Conversion of Energy, Future Sources of Energy, Glossary.

Energy and Man's Environment - Activity Guide
Ris, Thomas F.
Energy and Man's Environment, 2121 Fifth Avenue, Seattle, Washington 98121 (ED 106 070)

Provides educational strategies and materials needed for introducing energy to all grade levels on an interdisciplinary basis. Each chapter has four themes: (1) Scientific, (2) Ethical, (3) Aesthetic, (4) Utilitarian.

Energy Activities for the Classroom - 1976
Coon, Herbert L. and Michele Y. Alexander, 1976
ERIC Center for Science, Mathematics, and Environmental Education College of Education, The Ohio State University, 1200 Chambers Road, Third Floor, Columbus, Ohio 43212

Resource booklet of energy teaching activities divided into grade levels. K-3, 4-6, 7-9, 10-12.

Environmental Education: Strategies for Wise Use of Energy
Division of Science Education, North Carolina Department of Public Instruction, Raleigh, North Carolina 27611, c. 1974

Designed for use at all grade levels, therefore, activities are grouped K-3, 4-6, 7-12. An appendix contains charts. glossary, bibliography, checklists.

Fun With the Environment
Environmental Protection Agency
Washington, D.C., 1973, 20pp. (ED 103 213)

Activity booklet which helps young children learn about their environment. The booklet has a cartoon and coloring book format.

Heirarchy Chart
John Muir Institute for Environmental Studies, Inc., 2118-C Vine Street, Berkeley, California 94709

Comprehensive total concept chart which was to be used in developing environmental studies curricula to supplement existing K-12 programs.

Living Within Our Means: Energy and Scarcity
Environmental Educational Instructional Activities K-6
The University of the State of New York, The State Education Department, Albany, New York 12234

Instructional manual which illustrates ways in which environmental concerns may be integrated into the curriculum. Excellent activities arranged according to disciplines.

"Mickey Mouse and Goofy Explore Energy"
Walt Disney Productions, 1976
Public Affairs Department, EXXON, U.S.A.
P.O. Box 2180, Houston, Texas 77001

Very comprehensive, yet delightfully presented energy comic book. Copies are available from the above address. Covers previous sources of energy and possible future sources.

My Energy is Your Energy
Arizona Department of Education, February, 1974

Resource book and conservation activities designed for K-12.

Nuclear Power - Meeting a Need a New Way
Cedar Rapids Community Schools, 346 2nd Avenue, S.W., Cedar Rapids, Iowa 52404, c. 1972

Provides good suggestions as to teaching about nuclear power.

Student Learning Activity Module "The Energy Crisis"
Hughes, Judi and Lee County Environmental Education Program
Title III ESEA, 2266 Second Street, Fort Myers, Florida

Contains lesson plans, resource materials, and a Student Teaching Module on energy. Developed to help create an awareness of the causes, and some solutions for the energy crisis the world is facing.

Teacher's Handbook of Energy
Colorado Department of Education, Denver, Colorado 80023, c. 1974
(ED 119 957)

Provides teachers with information on energy and instructional activity suggestions.

Ways to Environmental Education, Volume III
Allen, Rodney F., Ed. and Others
Florida State University, Tallahassee College of Education, Tallahassee Junior Museum, Florida, 1975, 150pp.

Ten environmental booklets in one volume. One booklet covers energy learning activities for camp and home.

Wide World of Energy Kit
Walt Disney Productions, 1976
Walt Disney Educational Media Company, 500 South Buena Vista Street, Burbank, California 91521

Kit contains cassette and color filmstrip titled, "The Search for Power and Energy;" 18 full-color study prints; Energy Game; 30 copies of the energy comic book, "Mickey Mouse and Goofy Explore Energy;" 10 energy activity cards; teacher's guide with information and additional activities.

ANNOTATED TEACHER'S BIBLIOGRAPHY

EDUCATIONAL JOURNAL ARTICLES

Asimov, Isaac
"The Fascinating Story of Fossil Fuel"
National Wildlife
Vol. 11, November 5, August-September, 1973

Colorful charts could be helpful material for teachers.

"Energy Consumers Turn into Conservationists"
Nation's Schools
93: 4: 26-28, April, 1974

Describes how the topic of energy conservation has been introduced into school curriculums. Salem, Oregon; Marshalltown, Iowa; Des Moines, Iowa; Buckingham, Pennsylvania are mentioned specifically.

Fowler, John M.
"Does the Energy Theme Belong in the Classroom?"
Today's Education
65: 88-9, March, 1976

Teachers are encouraged to put more emphasis on energy education in the schools. Suggestions are given to make it interdisciplinary and goals are stated which aim to prepare the "students of today - citizens of tomorrow" for life.

Fowler, John M.
"Energy, Education, and the 'Wolf' Criers"
Social Education
pp. 245-256, April, 1976

Examines the background to the current energy crisis and outlines some possible solutions to the problems.

Glickman, L. J.
"Teaching Guide on Energy"
American Education
11: 40, June, 1975

Reviews an informative handbook entitled Energy Crisis Teaching Resources: A Special Publication Suggesting School Activities Which Stress Individual Responsibility Towards Energy Crisis Problems which was initially written for Oregon's Energy Crisis Week (December, 1973).

Hankla, Alice Kimbler
"An Energy Conference for Little People"
Science and Children
Vol. 12, No. 7, pp. 5-7, April, 1975

Reviews a conference which was held for children ages 4 and 5 at which they learned what energy is, how it works, and devised methods of energy conservation.

Harder, Peter J.
"Activity Cards Bridge Science and Social Studies"
Science and Children
Vol. 12, No. 7, pp. 8-10, April, 1975

Utilizing photography, the author developed a series of local photos to be made into activity cards with the questions on the back. Several different approaches to using the cards were suggested.

Hawkins, M. E.
"Energy: Future Alternatives and Risks"
Science Teacher
41: 25-7, April, 1974

Review of a two-day Academy Forum on Energy sponsored by the National Academy of Sciences. The Forum took up six propositions regarding energy. Many ideas were brought before the assembly.

Johnson, W. A.
"Energy Cricis: Not Only Why But What Can We Do?"
NASSP Bulletin
58: 28-36, May, 1974

Author expresses that the reason the U.S. is a nation of energy spendthrifts is that we have been paying far too little for the energy we use. Feels that a rise in prices will provide the incentive for conservation.

Konick, L. E.
"Energy Teaching Centers"
Science Teacher
43: 34-5, May, 1976

Author proposes setting up Energy Teaching Centers within a community for school children, parents and homeowners, and teachers. These centers would provide means for the local population to explore and encounter energy alternatives.

Kirman, J. M. and M. A. Nay
"Joint Planning for Integrating Social Studies and Science: Teaching About the Energy Crisis"
Social Education
39: 77-80, February, 1975

The authors express the hope that by encouraging the integration of social studies and science, schools will begin the process of providing an integrated curriculum.

Messer, Melanie B.
"Energy for Today and Tomorrow with Energy Eagle"
Science and Children
Vol. 14, No. 3, pp. 18-20, November/December, 1976

Delightful energy awareness activities produced by the San Diego County Department of Education for use with elementary students. Teachers are encouraged to adapt these to their own local situations.

Nesbitt, William A.
"The Energy Question: Problems and Alternatives"
Intercom
pp. 12-16, September, 1973

Proposes some ideas for teaching about the energy questions, charts, background information and data, and some suggested solutions with both the advantages and disadvantages.

Post, T. R.
"Energy Crisis: An Opportunity for Meaningful Arithmetical Excursions"
Arithmetic Teacher
22: 61-4, January, 1975

Suggests math activities which provide meaningful situations. Emphasis is to help students become sensitive to the implications a national crisis could bring.

Sartwell, J. G. and R. P. Abell
"Teacher's Guide to the Energy Crisis"
Today's Education
64: 90-7, January, 1975

Authors present facts about energy use, questions for students and teachers, alternative sources of energy, ideas for classroom use, and resources which are available.

Sommerkamp, P.
"Energy Crisis Gameboard"
Science Teacher
42: 39-40, June, 1975

Describes a game devised by students in Kentucky as a result of their study of energy. There are two versions - one without cards and one with cards.

"Starting Points - Energy: Plugging into the Fuel Crisis"
Learning
Vol. 2, No. 4, December, 1973

Aimed at teachers of K-8. Contains a series of activities to help students understand what energy is, as it flows through our life.

Yant, S. L.
"Facing the Energy Crisis in a Mathematics Classroom"
Arithmetic Teacher
23: 223-4, March, 1976

Teacher relates specifics of an eight-day project within a math class that created practical applications to the energy crisis.

MULTI-MEDIA MATERIALS

"The American Dream is Running Out of Fuel"
18 minutes, color, $230 or $19-rent (Gr. 5-8)
Films, Inc.
1144 Wilmette Avenue
Wilmette, Illinois 60091

"Bate's Car: Sweet as a Nut"
16 minutes, 16mm, color, $230 or $30-rent, 1975 (Gr. 5-12)
Arthur Mokin Productions
17 W. 60th Street
New York, New York 10023

Presents the inventor's energy-saving inventions, particularly his methane-driven automobile. Highly recommended by AAAS.

"Coalmining: The Story of Buried Sunlight"

Filmstrip, elementary

Ecology Activity Cards
BFA Educational Media
2211 Michigan Avenue
Santa Monica, California 90404

Some of the activities related specifically to energy. Others in the box guide the children towards conservation and the idea of using our resources wisely.

Ecology: Understanding the Crisis
Series No. 6454, c. 1972
Encyclopaedia Britannica Educational Corporation
425 North Michigan Avenue
Chicago, Illinois 60611

Filmstrip, records, guides. General coverage of what has caused the crisis, how man relates to his environment, a look into the future.

"The Economics of the Energy Problem"
Economic Topic Series
Teaching Resource Films, 1976

Sound filmstrip. Provides a basic overview of the energy problem.

"Electricity"
Community Series: Systems in Our City

Elementary level filmstrip.

"Electricity from Heat and Sunlight"
8mm film loop, color, with teacher's guide, $23.50 (Gr. 4-12)
Doubleday Multimedia

Shows how electricity can be produced from heat and sunlight.

"Energy"
Iowa Petroleum Committee

"Energy: A First Film"
8 minutes, sound, color (Gr. K-3)
BFA Educational Media
2211 Michigan Avenue
Santa Monica, California 90404

"Energy: Ability to Do Work"
9 minutes, color, sound (Gr. 5-8)
AIMS Instructional Media Service
P.O. Box 1010
Hollywood, California 90028

"Energy and Power - A First Look"
10 minutes, 16mm, 1962 (Primary - Intermediate)
Journal Films

Outlines, from the days of the caveman to the present, many ways in which man harnesses energy and increases his capacity to do work by utilizing the potential energy found in wood, wind, and running water.

"The Energy Challenge" - Kit, c. 1975
Pollution Control Education Center
Township of Union Public Schools
Union, New Jersey

Grade level undesignated, however, could be used in Gr. 6 with some modification and for the junior high. Contains student booklets, teacher's guide, two filmstrips with cassette, duplicating masters, activity cards, and overhead transparencies.

"Energy Crisis"
13 minutes, 16mm, color, 1972 (Gr. 4-9)
Journal Films

Reviews the different energy sources and indicates the length of time we may be able to depend on them. Shows the possibility of solutions and developments which may some day provide unlimited power to meet our needs.

"Energy Crisis Game," 1973 (Upper elementary and junior high)
Intemation, Inc.
New York, New York 10001

For 2-6 players.

"Energy Game"
Northern Natural Gas"

Twenty minute slide and sound show followed by a quiz, designed for grades 4-6. The stress is upon energy conservation with a short review of where energy comes from.

"Energy With a Capital C - for Conservation"
Energy Policy Council
707 East Locust
Des Moines, Iowa 50319

Slide presentation complete with slides, audience pamphlets, and a recorded cassette of the slide narrative.

"First Film on the Wind"
9 minutes, 16mm, color, sound, c. 1966 (Elementary)
BFA Educational Media
2211 Michigan Avenue
Santa Monica, California 90404

Shows how, though one cannot see the wind, he can see what the wind does, such as making waves on the water, swaying trees, and lifting kites. Shows how rain clouds come and go with the wind.

"Global Emergency: Energy"
Guidance Associates, c. 1975 (Gr. 6)

Two sound filmstrips, "New Sources, New Values" and "The Energy-Aware Society," which deal with the various alternative sources of energy. It also looks at the social, economic, and political problems in our world of shortages. The students also look at alternative life-styles.

"The Great Search: Man's Need for Power and Energy"
13 minutes, 16mm, color, with teacher's guide, 1972 (Gr. 4-up)
Walt Disney Production

Traces history of man's attempts to harness energy of sun, water, lightning, etc. in order to produce power needed for daily living.

"Man's Search for Energy"
Filmstrip, 36 frames, $6.75 (Gr. 5-8)
McGraw-Hill Films
1220 Avenue of the Americas
New York, New York 10020

"Our Energy-Based Economy"
EEI Pub. No. 74-54
Edison Electric Institute

A multi-media instructional program for Gr. 6-8. Contains four filmstrips, four records, duplicating activity sheets, duplicating pre/post assessment sheets, and a teacher's guide.

"Our Energy Supply"
Part of The Only World We Have Series (Gr. 6)
Narrated by Dr. Leonard Reiffel and Miss Moones, Bell and Howell

Twenty minutes, two-part tape. Presents a wide variety of the problems relating to our energy usage. Covers definition of energy, present sources, explains origin of our energy problem, possible energy sources.

"The Petrified River"

Film available from Iowa Electric Light Company.

"Power"
Color filmstrip, 53 frames. Sound with cassette or record. (Intermediate - Junior High)
From Water and How We Use It Series, 1971
6 filmstrips with cassettes, $70.00; with records, $55.00
Coronet Instructional Films

Shows how water power helped the development of early industry and how water supplies power for hydroelectric energy from the water and how we use it.

"Power and Energy"
Set of two filmstrips, record or cassette, automatic and manual, $25.00 per set
18-20 minutes, color, 50-59 frames, with teacher's guide (Gr. 5-9)
Educational Activities

Answers such questions as: Where does energy come from? How is it produced and distributed? Why are there "Brown-outs?" How do you produce power from fossil fuels, fission, fuel cells, ocean, solar energy?

"A Practical Guide to the Energy Crisis," 1975
Schloat Productions Distribution Center
West Nyack, New York 10994

Two excellent color filmstrips, two records or cassettes. Part One: "Reasons for the Crisis," 89 frames, 10 minutes. Part Two: "Responding to the Crisis," 78 frames, 11 minutes. (Gr. 6-8)

"Science and Society: An Inquiry Into Technology and Values: Energy," 1975
Schloat Productions Distribution Center
West Nyack, New York 10994

Excellent sound filmstrip program containing two filmstrips with cassettes. Filmstrip I - "Power Struggle," 101 ft., 19 minutes. Filmstrip II - "Future Power," 103 ft., 19 minutes. (Gr. 6-8)

"This Earth: Everything Fits Together," 1973
Guidance Associates

Multi-media learning experience for the elementary years. Children see that everything is interdependent and that the sun is the energy source for all life on earth. Sound filmstrips, study cards, poster, game poster, stencils, work sheets, and teacher's guide.

"The World of Energy"
Filmstrip (Gr. 5-8)
National Geographic Society
Department 1037
Washington, D.C. 20036

TEACHER'S RESOURCE LIST

In addition to those listed below, specific suggestions are also included within the packets with the activities.

1. AEA - Area Education Agency

   Check their film and book catalogs and any other material they have available.

2. Chamber of Commerce

   Contact for help in locating local solar buildings and homes, industries which may be cooperative, etc.

3. C.U.R.E. (Citizens United for Responsible Energy)
   1342 30th Street
   Des Moines, Iowa 50311 (515/277-0253)

   Contact for information and speakers.

4. Iowa Energy Policy Council
   707 East Locust
   Des Moines, Iowa 50309 (515/281-4420)

   Contact for information and speakers.

5. School custodian.

6. Utility and Power Companies.

WILL YOU HELP US?

Use the following space for suggestions, criticisms, or comments. We welcome any contribution you may wish to make. Please send these to Duane Toomsen, Environmental Education Consultant, Curriculum Division, Department of Public Instruction, Grimes State Office Building, Des Moines, Iowa 50319.

Name _____

Address _____

City _____ State _____ Zip _____

School _____ Grade _____

How did you use the Packet?

Was it relatively easy to integrate the activities into existing studies?

What were your feelings about the values activities?

How could the packets be improved?